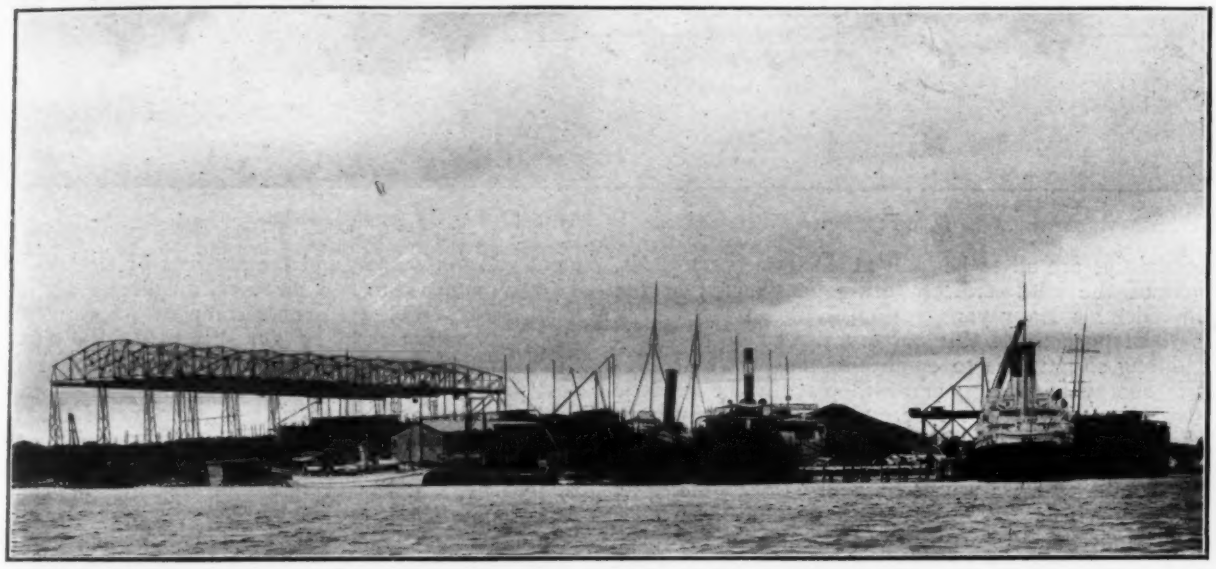
Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

VOL. 71—No. 1. CHICAGO, SATURDAY, JULY 7, 1917.



Water-Front View of An Eastern Ship Yard.

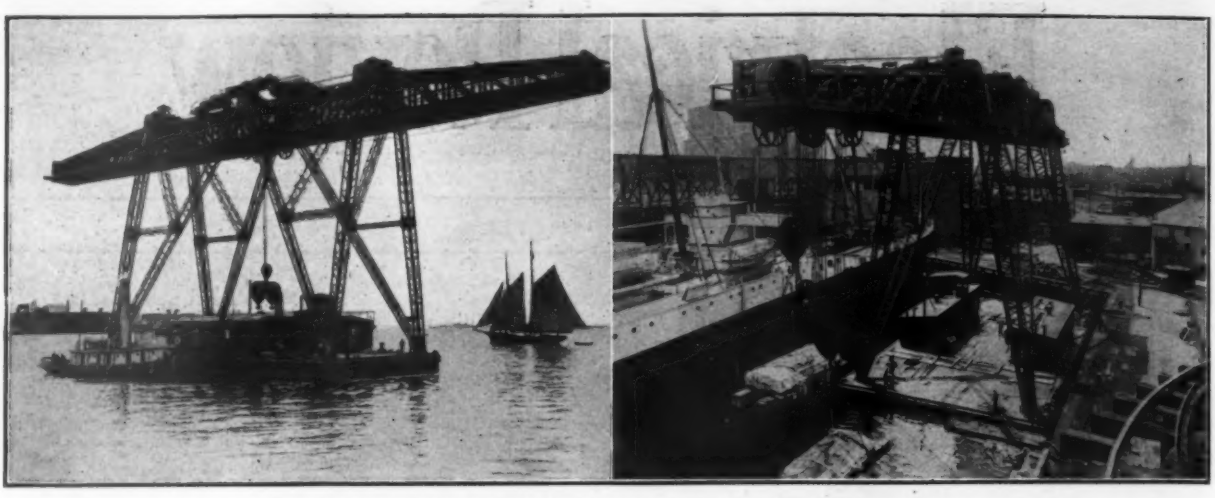
Electricity in Shipbuilding Operations

The Tremendous Impetus Given This Industry Has Created an Unprecedented Opportunity for Central Stations and Manufacturers of Electrical Equipment—A Resume of Present Activities

ONE of the sources of greatest prosperity to the electrical industry, both present and prospective, is the shipbuilding activity in the United States. This statement has reference both to the supply of electrical equipment and to the consumption of electric power. Practically every shipbuilding plant in the country has been enlarged and provided with much new equipment within the last two years, a considerable number of new yards have been built and equipped, and many others are under construction. This unprecedented activity, resulting from imperative demands, is in evidence not only on the Atlantic and Pacific seaboards, but on the Gulf Coast and the Great Lakes. The cost of improvements and installation of new equipment now being made in the Navy yards of the country at present will be much in excess of $100,000,000, and shipbuilding corporations have spent, and are still spending, large amounts, increasing their facilities for the construction of cargo vessels, oil carriers and ships-of-war. While the major proportion of the ships being built are of steel construction, the building of composite and wooden vessels is becoming no small factor in meeting the demands for ships. In this connection, the twelve contracts awarded last month by the United States Shipping Board of the Emergency Fleet Corporation may be mentioned, under which 104 merchant ships are to be built and delivered between January 1 and August 1, 1918. This work calls for 18 steel ships, 32 composite, and 30 wooden vessels. Eight of these contracts went to Pacific coast yards.

The shipyards of the country, not including the Navy yards, had over 400 steel ships, of 1,495,600 gross tons displacement, under construction on January 1, 1917. This number comprised 294 general cargo vessels, 76 oil and syrup tankers, 7 passenger and cargo vessels, 8 car-floats and ferries, 11 towing vessels, and others of different classes. These figures may serve as a basis for estimating the number that may be under construction by January 1, 1918.

Naval vessels, for the construction of which contracts recently were awarded, include the following: Five battle cruisers, 34,800 tons each; four battleships of 32,600 tons each; three battleships of 42,000 tons; 44 torpedo-boat destroyers, each of 1185 tons; 200 submarines, 64 of which are being built in Government yards. Of these, the battle-cruisers and



The Pontoon Electric Crane Is An Important Adjunct to Shipbuilding.

battleships are all to be built at Atlantic coast yards, one of the battle-cruisers being constructed at the Philadelphia Navy yard.

The purpose of this cursory survey of the shipbuilding situation is to emphasize the part that electric energy is playing and will play in the gigantic strides of this nation in creating a naval and merchant marine, to carry on and protect its commerce and to protect its shores. In the modern shipbuilding plant there are scores of applications of electric power, such as the operating of machine-shop tools, cranes, air-compressors, hoists and conveyors, as well as for yard haulage, either by trolley lines or storage-battery trucks. Not only this, but the electrical installations aboard new ships mean demands for equipment and appliances, and the services of electricians. To the manufacturer of electrical machinery and appliances, to the electric-power company whose central station is within reach of our ship-yards, the opportunity afforded is unparalleled in the annals of industry.

It is manifestly impossible to conceive of the tremendous proporions of this vast industry, or of the opportunities that are offered the electrical industry to participate. However, we give in the appended paragraphs a brief outline of the present and contemplated activities in various sections of the country. These data have been carefully compiled to indicate what share the electrical industry is playing and what may be expected in the immediate future.

Activities on the Atlantic Seaboard

THE Newport News Shipbuilding & Dry Dock Company, Newport News, Va., is surpassing all of its prior records in ship construction, having had more such work in its shop last March than at any other date in its history. Eight steel ships were delivered from its yards in 1916, including the battleship *Pennsylvania*, and the volume of work in these shops at the close of 1916 amounted to over $50,000,000. Since then the super-dreadnaught *Mississippi* has been launched, while three other warships of 96,000 tons displacement, and 12 cargo ships of an aggregate tonnage of 86,373 have been under construction. There are over 7000 men on the payroll, to whom more than $100,000 per week is paid.

It may be of interest to note that the following-named steel ships were under construction at the Newport News yards in March, 1917, some of which have since been launched: The *H. M. Flagler*, oil carrier, 8375 tons, for Standard Oil Company; the *W. G. Warden*, oil carrier, 11,000 tons, Standard Oil Company; *F. O. Barstow*, oil tanker, 11,000 tons, for Standard Oil Company; *O. B. Jennings*, oil ship, 11,000 tons, Standard Oil Company; the *J. C. Donnell*, oil tanker, 11,000 tons, for Atlantic Refining Company; the *Felix Taussig*, merchant ship, 6000 tons, for Crowell & Thurlow Steamship Company; and three ships, not named, 4600 tons each, for the Munson Line; the *Torres*, 5200 tons, the *El Almirante* of 4500 tons, and the *El Capitan* of 4500 tons, all merchant vessels, for the Southern Pacific Company; the *Mississippi*, *West Virginia* and *Maryland*, super-dreadnaughts, each of 32,000 tons, for the Navy Department. The *West Virginia* and *Maryland* contracts from the government were awarded at $11,235,000 each; and more recently contracts were let to this company for building the battleships *Colorado* and *Washington*, each of 31,200 tons displacements, at $11,450,000 each; and contracts for battle cruisers Nos. 1 and 2 were taken at cost plus 10 per cent.

The Newport News yards do their part of naval construction, notwithstanding the fact that they could easily be fully employed on private contracts, many of which have been turned away. In order to facilitate the handling of this greatly increasing volume of business, the company expended $750,000 during the past year for the installation of new equipment. In the mechanical and electrical line, a great north-south traveling crane was erected for transporting material and parts from the machine shops to the shipping ways. The plant occupies an area of 125 acres and has deep-water frontage of half a mile. There are seven ship-ways, six of which are served by cantilever cranes operating on trestles; in addition to this there is a system of electrically operated carriers to convey material and parts to any one of the shipways. The three basin dry docks have lengths of 639 feet, 861 feet and 585 feet, respectively, and widths of 130, 162 and 147 feet, respectively. These are served by one 150-ton revolving crane and fixed derricks, with floating derricks to facilitate placing machines or heavy parts upon ships afloat. The machine shops, in addition to the usual array of modern motor-driven machines and tools, include special machines employed in the construction of steam turbines.

The equipment necessarily involves many electrical installations. The ship shed, the framing shed, and other service buildings are grouped close to the building slips. There are two foundries, one for iron and steel castings, the other for brass. The company's motto, announced by Collis P. Huntington, founder of the yards, is this: "We build good ships here, at a profit if we can, at a loss if we must, but always good ships."

The Fore River Yards.

The Fore River Shipbuilding Corporation, having yards at Quincy, Mass., is a subsidiary of the Bethlehem Steel Corporation. Its yards, proper, cover a 40-acre tract, is on a land-locked harbor, and at low tide has 28 feet of water at its wharf. The company's railway, nearly two miles in length, connects the yards with New York, New Haven & Hartford railway lines. There are nine building slips, with ship-fitters shop for fabricating, handling, assembling and riveting structural steel for ship construction. This shop, built in 1916, occupies a ground space 775 by 185 feet. It is laid off in two bays, each of 90-foot span, with two overhead cranes for each bay. Below these are a number of wall cranes for special machines and tools; also jib cranes for serving various heavy machines.

All cranes are electrically operated. In the plate yards, the structural material is received on cars and thence handled by three gantry cranes; two storage battery trucks are used for hauling material into the shop from which it is handled by overhead cranes to proper positions, and other similar trucks are used for carrying material lengthwise of the shop. Included in yard equipment are four industrial cranes. The machine shop is modernly equipped for large capacity. The output, for some months, amounts to 1,000,000 pounds of machined material. In the last 14 years the company has had under construction 165 ships, including the battleships *Rhode Island, New Jersey, Vermont* and *North Dakota* for the United States Navy, and the *Revidavia* for Argentina; the last battleship built at these yards was the *Nevada*, which is now in naval service. A force of 4500 men is employed. A contract for the construction of battle cruiser No. 4, of 34,800 tons displacement, was recently let to this company at cost plus 10 per cent; also a contract for a number of torpedo boat destroyers went to this company.

The Cramp Ship Yards.

The Cramp Ship & Engine Building Plant, Philadelphia, embraces Cramp's ship-yards, the Kensington ship-yards, the I. P. Morris Company, and the Federal and Foundry plant. As in the cases of other big yards, the Cramp's organizations made extensive improvements during 1916. These comprised a new ship shed, the installation of two cranes for wet dock work, two building slips, with three cranes to serve them. During 1916 there were under construction 16 vessels; including four torpedo-boat destroyers, seven oil tankers, two passenger and cargo vessels and two freighters. This work has been greatly augmented by the taking on of other contracts, including the contruction of two scout cruisers for the government, of 7100 tons each, at $5,950,000 each, and several destroyers.

A Typical Shipyard Scene—Hundreds of Such Plants Are Working Night and Day.

The New York Yards.

New York Shipbuilding Company, having yards at Camden, N. J., had 28 cargo vessels building in 1916, contracts for which amounted to $10,000,000, which with naval construction during the same year brought the sum up to $23,000,000. Some of these contracts are engaging attention during a part of 1917. Government contract for battle cruiser No. 3, of 34,800 tons displacement, was awarded to the company this year at cost, plus 10 per cent. The company employs over 4000 men.

Maryland Steel Company.

The Maryland Steel Company, subsidiary to the Bethlehem Steel Corporation, has a busy yard at Sparrow's Point, Md., where over 4000 men are employed. During 1916 it had 13 steel ships in course of construction, the contract prices of which amounted to $10,500,000. Facilities were taxed to the utmost and big expenditures were made on improvements to greatly increase capacities. The yards now have six building ways, four electric traveling cranes of 12.5 tons each, and two of 15 tons each. The new ways built last year are capable of accommodating vessels of 653-foot length, and 75-foot beam.

Baltimore Yards.

The Baltimore Dry Docks & Shipbuilding Company spent $200,000 for repairs and improvements during 1916. While much attention is devoted to ship repairing, the company has built a number of oil tankers.

Elliott Machine Corporation, Baltimore, Md., was awarded the contract for the construction of 12 vertical triple-expansion marine engines for the Emergency Fleet Corporation.

Bath Iron Works.

Bath, Me., is active in the construction of steel ships. The Bath Iron Works, Ltd., have a complete and modern plant, where special skill has developed in building fast steamships, one of its specialties being the Parsons steam turbines. During 1916 several torpedo-boat destroyers were built for the government. The shop capacity and efficiency have been increased since 1915 by the installation of new tools; among the features of new equipment was a 75-ton electrically-operated wharf crane for placing machinery or other heavy loads on ship-board. Current for power at these works is supplied by Central Maine Power Company, of Augusta.

The building of four wooden hulls for the Emergency Fleet Corporation was awarded to the Portland Ship Building Company, Portland, Me., to be delivered between February 1 and June 15, 1918.

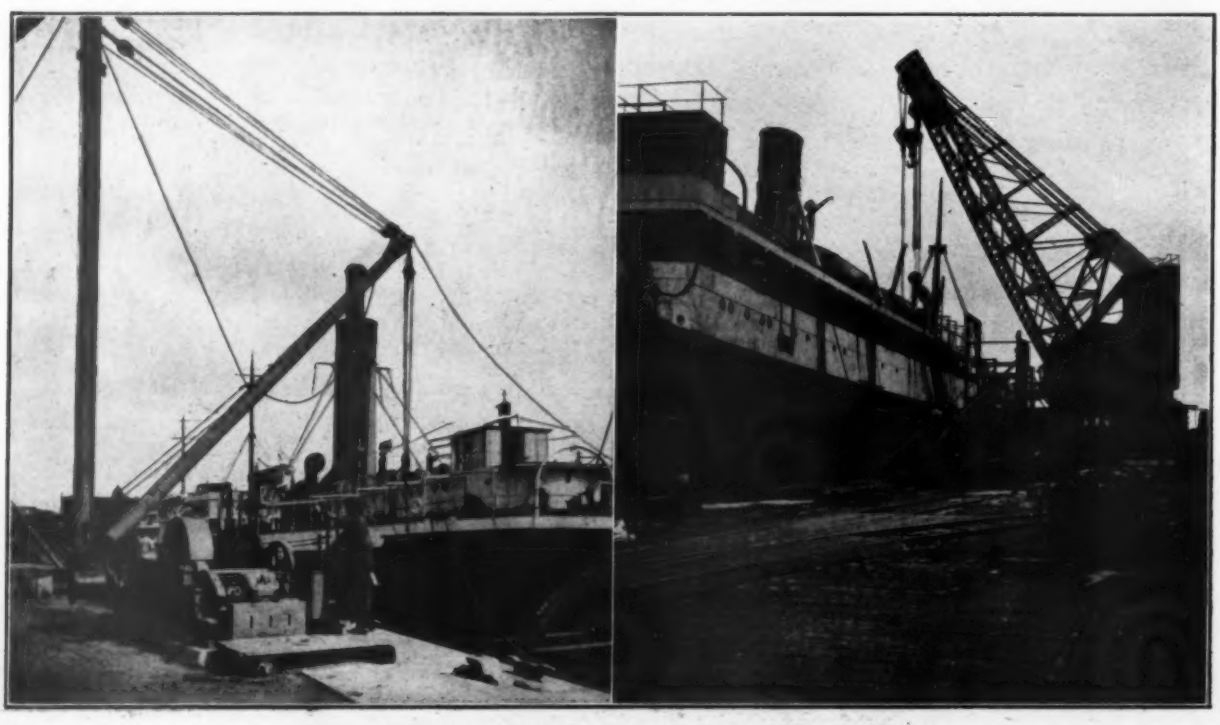
The Harlan & Hollingsworth Corporation is subsidiary to the Bethlehem Steel Corporation and employs 2000 men at its shipbuilding plant on Christian River, Wilmington, Del. The yards have five new ways and work of the volume of $10,000,000 was turned out in 1916.

United States Steel Corporation.

The latest group of financial men to enter the shipbuilding industry is the United States Steel Corporation, through the American Bridge Company, one of its subsidiaries. It is reported that 3,000,000 tons of steel have been contracted for to use in ship construction. This tonnage of steel is to be fabricated by the American Bridge Company, the Lackawanna Steel Company and other concerns. The U. S. Steel Corporation has bought 60 acres of land on Newark Bay, from which the open sea may be reached via Staten Island Sound.

The Foundation Company.

A company of above name has been incorporated to build wooden ships, on New Jersey Meadows, where six ways have already been provided for the construction of 10 steamships, each of 3000 tons displacement, for which contracts have been awarded by



Electric Derrick and Electric Crane at Newport News Yards.

Two Views of Standard Shipbuilding Company's Yards.

the U. S. Shipping Board at $3,000,000. Work on the first ship was recently begun. Franklin Remington is president of the company.

THE NAVY YARDS.

The United States Government's expenditures for navy yard improvements, naval training stations, submarine bases, equipment of gun shops and other work initiated this year will amount to more than $100,000,000. This includes new building ways, new shops and foundries, with the necessarily extensive electrical equipment. The gun shops at the New York yards will be the largest of their kind in the world. Expenditures at the Philadelphia yards on new ways, machine shop and foundry, and the necessary new structures will amount to $18,000,000; the construction of a new dry dock, 1000 feet long, and shops and foundry, at Norfolk yards will cost $20,000,000. The expansion of the naval gun factory at the Washington navy yards will require $7,000,000. The program also provides for improving facilities at Bremerton navy yard, on Puget Sound, at a cost of $3,000,000; and similar work at Mare Island yards, near San Francisco.

Since the creation of Government Shipping Board in September, 1916, that board has awarded contracts to build ships of an aggregate of 813,000 tons displacement, classified as follows:

Class.	Number.	Tonnage.
Steel ships	38	316,000
Wooden ships	34	133,000
Composite ships	32	112,000
Wooden hulls	72	252,000

The steel ships range in tonnage from 5000 to 10,000 each; the wooden vessels average about 3500 tons each.

Activities on the Gulf Coast and Great Lakes

THE Star Shipyards, of New Orleans, are being equipped at a cost of $250,000, for the construction of wooden ships. It is reported that shop tools, electric cranes and pneumatic machines will be installed. Contracts already have been secured for building six wooden hulls and 2000 to 3000 men will be employed.

The National Shipbuilding Company is to equip yards of seven building ways at Orange, Tex., for the construction of wooden ships and oil-tank steamers.

The Universal Shipbuilding Company, New York, having yards on Houston ship-canal, near Houston, Texas, has been awarded contracts for building 12 wooden ships by the Emergency Fleet Corporation, deliveries to be made of two ships at a time, in seven, nine, ten, eleven and twelve months after completion of ways, which are under construction.

McBride & Law, Beaumont, Texas, have been awarded a contract to construct four wooden hulls, for delivery between March 1 and June 1, 1918.

The Alabama Drydock & Shipbuilding Company, Mobile, Ala., is employing 900 men in the repair and construction of ships, electric power for operations being supplied by Mobile Electric Company, the latter controlled by H. M. Byllesby & Company, Chicago. The shipbuilding company and the electric company are closely allied.

The membership of the Lake Carriers' Association represented a total of 2,013,962 tons at the beginning of 1917, and this has been materially increased by the completion of new vessels since that date. The ships represented in this association are engaged largely in the lake transportation of iron ores and grain, both of tremendous importance under existing conditions.

The American Shipbuilding Company with yards and docks at Cleveland and Lorain, Ohio, entered the year 1917 with greatly increased facilities, especially at its Cleveland yards, where a new foundry, machine shop, pattern shop and office building were constructed and equipped in 1916. This required electrical installations on a large scale and a great increase in the consumption of electric power. The band-saws, joiners, planers, lathes and other machines in the woodworking shops are motor-driven.

The new machine shop is equipped with a splendid array of electric-driven machines and tools. All large tools are operated by individual motor drive.

The new facilities at this plant were provided in 1916 to supply the heavy demands with which the company was confronted. Its energies are mostly directed to the construction of merchant steamers.

SUPERIOR SHIPBUILDING COMPANY.

Three ocean cargo vessels have been launched from the yards of Superior Shipbuilding Company, at Duluth, this season—the *Cleveland*, the *Toulouse* and the *Poitiers*. The *Cleveland's* initial trip was to Norway;

the other two are in service on the French coast. Two other ships, on the ways of this yard, originally ordered for the Cunard Line, have been taken over by the United States Government and work on same is being rushed.

The McDougal Duluth Shipyards are active in shipbuilding; also the Marine Iron & Shipbuilding Company. Both of these establishments are being supplied with power from the lines of the Duluth Edison Company.

Pacific Coast Activities

THE three plants of the Union Iron Works, San Francisco, give employment to 8000 men. These combined works are provided with 10 building slips, three floating and one graving docks, and two marine railways. The works are equipped for building dreadnaught battleships and battle-cruisers of the largest type, and have the capacity for producing 30 ships per year. Besides the construction of naval ships and cargo vessels, a heavy business in ship-repairing is carried on, and many gold-mining dredges are built. The historic warship *Olympia*, the famous battleship *Oregon*, and later the armored cruisers, *California* and *South Dakota*, were built at these works. Enlargements of the works and increase of facilities are all the time in progress. Naval ships now being built at the Union Iron Works plants consist of two scout cruisers, each of 7700 tons displacement; 16 torpedo-boat destroyers, and hulls for 18 coast-defense submarines, the machinery on same being supplied by the Electric Boat Company. The Union Iron Works, San Francisco, and Fore River Shipyards, Quincy, Mass., both controlled by Bethlehem Steel Corporation, share in the naval contracts taken on by the Bethlehem

Moore & Scott Iron Works.

In the recent award of contracts by Gen. George W. Goethals, manager of the Emergency Fleet Corporation, for steel and wooden cargo ships, the Moore and Scott Iron Works, San Francisco, received the contract for building 10 steel ships. Deliveries are specified as follows: The first two in February, 1918; the third in March, the fourth and fifth in June, the sixth in August, seventh and eighth in October, and the ninth and tenth in November, 1918.

Great demands for shipbuilding in the Pacific Northwest are being met by a rapid increase of facilities for such work in Seattle, Portland, Tacoma and other shipping centers of that section. This refers both to steel and wood construction. Plants not originally constructed for this class of work were quickly adapted to shipbuilding requirements, and many new plants have been established and specially equipped for ship construction. Meantime, the number of men employed in this industry has increased between 100 and 150 per cent within the last year. The construction of new plants and the enlargement of the older plants created great demand for electrical equipment, for power and light, and has resulted in drawing upon the electric power companies for current almost to the limit of their capacities. But the Northwest has exceptional water-power resources and there is no doubt that hydroelectric generating facilities will continue to be such as to meet all demands.

The electrification of some of the Seattle shops is specially referred to in accompanying paragraphs. The application of electric power to overhead traveling cranes, aerial handling systems, circular cranes, shop machinery, cable conveyors, and for lighting shops and yards, represents the best practice and embodies some features of special interest.

Features of Seattle Plants.

The shipbuilding plant of J. F. Duthie & Company is one of the new establishments on Puget Sound. The premises comprise 12 acres, of which about four acres are under cover. The steel fabricating shop is 900 feet in length and is served by overhead traveling cranes. The shop sets parallel to the four building ways, as is also the structure occupied by machine shop and blacksmith shop, the latter two shops being served by one traveling crane. The building ways, yard equipment and general layout are calculated to be sufficient to turn out one steel vessel per month.

This shop has the most modern tools and equipment, including 30-foot and 15-foot planers, 30-foot bending rolls, and 12-inch beam benders. The larger tools are served by cantilever wall cranes, in addition to the overhead traveling cranes. This company has 10 general cargo vessels on order, all being steel ships of the same size—423 feet long, 54 feet beam, and 29 feet moulded depth. They are being equipped with 2500-horsepower geared turbines and Scotch marine boilers.

Skinner & Eddy Corporation, whose plant is on the main Seattle water front, within the last year has built four 8800-ton steel cargo vessels and two oil tankers of 9500 tons each. Four other cargo vessels of the same type as the first four, have recently been under construction, one of which was launched in May. One of the 9500-ton oil tankers, built for the Standard Oil Company, was delivered in May, and the other for the same company was delivered in June, this year. They were equipped with Curtis geared turbines and Scotch marine boilers.

The Skinner & Eddy yards embrace 15 acres. Three building ways have been in use, but the fourth was completed and put in service in June, 1917. The latter is capable of handling a 600-foot vessel. The conveying of material over ships under construction is accomplished by a system of cable conveyors, designed by David Rodgers, general manager. These conveyors are able to make trips from a point near the bow of the ship to the stern in three to four minutes, carrying a maximum load of 10.5 tons. Operating and hoisting are by means of electric winches, and the electric signaling from ship to winch operator is accessory to the conveying system.

Ames Shipbuilding & Dry Dock Company, builders of steel cargo vessels and oil tankers, has a new plant on Seattle's west waterway. This company has a contract for the construction of 12 vessels, including several 8500-ton carriers for the Cunard Company. The building of a floating dry dock of 10,000 tons capacity at these yards has been planned, and work on same probably will soon be in progress. The electrical equipment for power and lighting was completed in May, the interesting features of which are described in a special article in this issue.

The Seattle Construction & Dry Dock Company has orders totaling $33,000,000, and employs 3500 to 4000 men, running two shifts in all departments. Of the six building ways, five are of large size, one being of smaller dimensions. The work in progress is tremendous, notwithstanding the fact that many changes in shop installations were made during the earlier months of the year. As in other plants on Puget

Sound, the overhead conveyor system for handling material to the building ways is of special interest. It consists of 16 sets of poles, carrying 2-inch cables, having a 650-foot span. Three such cables are provided for each building ways, each one being capable of making five-ton lifts; the three can be combined to handle a 15-ton load. One ship per month is being turned out at the plant. Government work on scout cruisers and torpedo-boat destroyers constitute a large item. Two of the ways are devoted to the construction of merchant vessels. A recent contract taken was for partly reconstructing and repairing equipment of the steamship *Congress* of the China Mail Steamship Company. Much new machinery will be installed.

The greatest activity prevails among the smaller shops and foundries, and tool-making shops have sprung up and are crowded with business. The shops devoted to electrical work are full of business, the larger share of their activity being due to the high pressure of the shipbuilding industry.

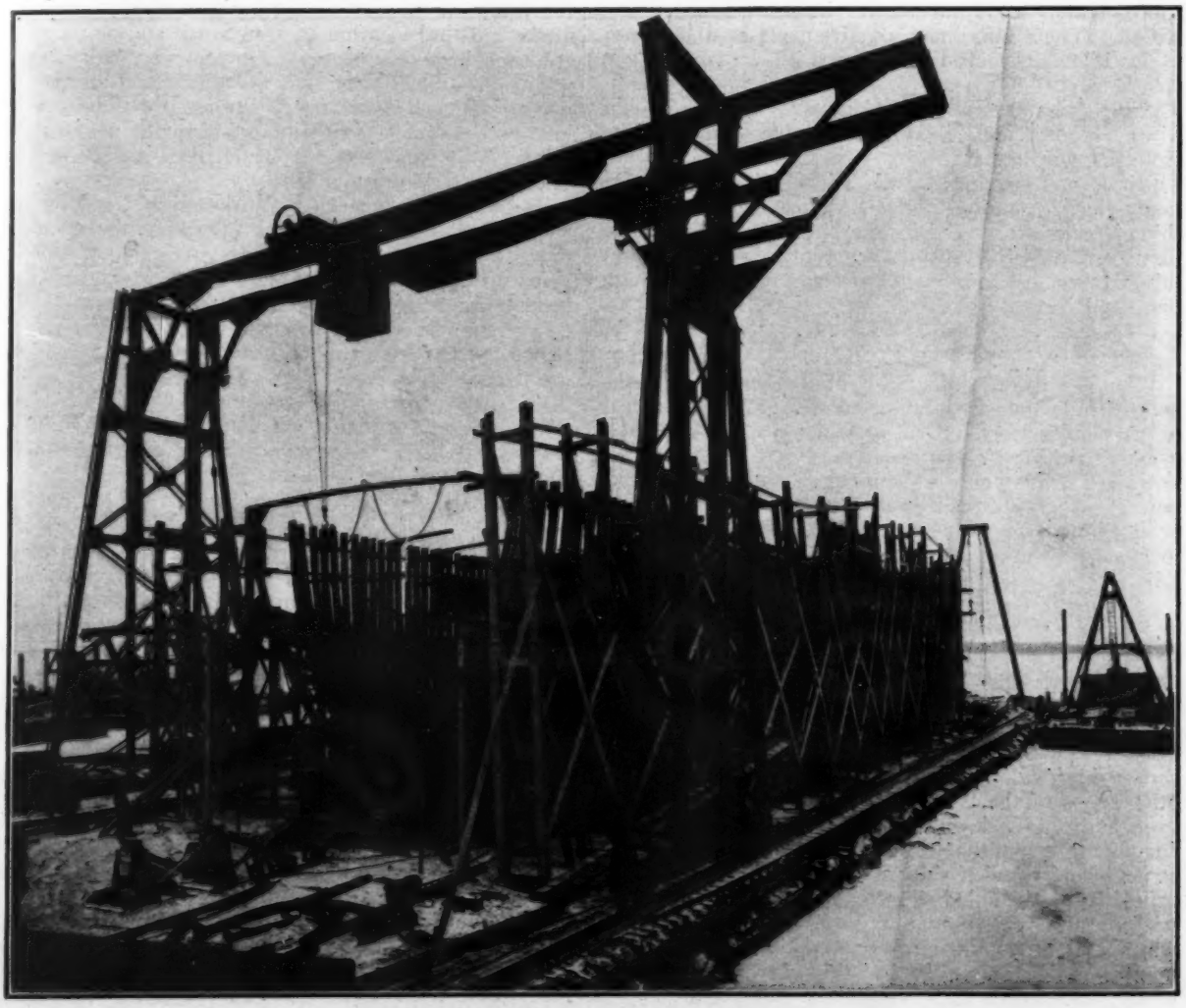
The National Shipbuilding Company, Tacoma, is constructing wooden ships, several contracts for which amount to about $1,000,000. F. Garrett Fisher is at the head of this company. Among the newer concerns entering the shipbuilding field are the Anacortes Shipbuilding Company, which will establish a yard at Anacortes, Wash., Tacoma Shipbuilding Company, Tacoma, and the Nelson & Kellez Shipbuilding Company, Seattle. Many of the smaller plants are busy with sub-contracts from the larger concerns, and shops which make a specialty of certain parts of vessels and equipment are fully employed.

Shipbuilding plants on the Northwest coast have been refusing practically all private offers for wooden ships until it was learned just what was expected of them according to the government's program. The suggestion of Major-General Goethals that the shipbuilders of the Northwest form a shipping pool, with an agent to handle its affairs, met with hearty approval. At least six established plants in Seattle were put in readiness to begin construction on short notice. Shipbuilders state, however, that private contracts are to be had in large numbers, and as soon as the government work is provided for these will be accepted.

Shipbuilding at Portland, Ore.

Portland has not less than 10 shipbuilding plants on the Willamette River. These are of two classes: First, those equipped for the construction of all-steel cargo ships; second, those equipped for building wooden cargo ships, in some cases with steel reinforcement. In the class first named are the Northwest Steel Company, Columbia River Shipbuilding Corporation, and Albina Engine & Machine Works, situated within the limits of the city of Portland.

The Northwest Steel Company has been engaged



Electric Gantry Crane in Use at Shipyard.

in the construction of steel cargo ships of from 8000 to 10,000 tons displacement for the past 18 months. Two ships have already been completed and launched and four others are in various stages of completion. Electric motors installed aggregate approximately 2500 horsepower in capacity; the maximum demand being approximately 1200 kilowatts, and an average of 375,000 kilowatt-hours per month is required. The plant has four established ways and is contemplating additions thereto.

The Columbia River Shipbuilding Corporation is engaged in the construction of steel cargo ships of from 8000 to 10,000 tons capacity and has been operating approximately six months. Three ways are provided and a total of about 2000 horsepower in electric motors are required. Kilowatt-hours per month when the plant once gets into full operation will be in the neighborhood of from 250,000 to 300,000, and the maximum load will be approximately 1000 kilowatts. This plant is allied financially with the Northwest Steel Company and it is understood that, together, they have contracts for the construction of about 18 vessels of the type above described.

The Albina Engine & Machine Works has been constructing steel cargo ships of from 5000 to 8000 tons displacement for approximately nine months past. They are equipped to handle the construction of three such ships at one time and it is reported that they have seven of them on order. They have a total of approximately 1500 horsepower in electric motors installed. Their maximum requirements will be close to 600 kilowatts and about 175,000 kilowatt-hours per month used.

The Northwest Steel Company and Columbia River Shipbuilding Corporation receive power service from the Portland Railway, Light & Power Company, which is well equipped both with hydroelectric and steam-electric stations. The Albina Engine & Machine Works are served by the Northwestern Electric Company, which transmits current to its Portland sub-stations from its hydroelectric plant on White Salmon River in Washington.

Wooden Shipbuilding Activity.

In the wood shipbuilding line there are at the present time six yards, either erected or in the process of erection in Portland, all of which are using, or will use, electric energy for power purposes, and one plant now operating where steam engines are the motive power. As far as can be ascertained, there are four or five other companies in the process of formation to engage in the construction of wooden ships. Details of this latter class are not available at this time.

Peninsula Shipbuilding Company has been in operation about 18 months. It has completed and launched two wooden ships of dead weight capacity 4000 tons; has installed approximately 225 horsepower in electric motors, requires a maximum of 110 kilowatts, and uses approximately 22,000 kilowatt-hours per month. Three ways are provided with facilities for three additional. This company has contracts for six other ships of the type above indicated.

Standifer-Clarkson Company has been in operation for about 12 months. It has three ways for the construction of wooden ships of from 3000 to 4000 tons capacity; has installed close to 200 horsepower in electric motors, with a maximum demand of 100 kilowatts and an average of 12,000 kilowatt-hours per month used. Two ships of this class have already been completed and launched and two more are in the process of construction. Another company, allied to Standifer-Clarkson Company, is engaged in the construction of a yard at another location, to have six ways to build wooden ships of 4000 tons displacement, with an installation of about 450 horsepower, a maximum demand of 200, and an estimated kilowatt-hour consumption of 30,000 per month. Information is that ten boats have been contracted for construction at this location.

Kiernan & Kern is now engaged in the construction of a yard for building wooden ships of about 3000 tons displacement. Two ways have been provided and additional facilities are available for the construction of two more. Their total installed capacity will aggregate approximately 175 kilowatts and their maximum load 90 kilowatts. Their average use of electric energy will amount to about 12,000 kilowatt-hours per month.

The Coast Shipbuilding Company is constructing a yard with four ways for the purpose of building wooden ships of 4000 tons displacement. Their plans call for an installation of 250 horsepower in electric motors, prospective demand of 125 kilowatts and an average of 25,000 kilowatt-hours per month. This concern has contracts for six wooden cargo ships as above described.

The Supple & Ballin ship-yard has been in operation during the last six months and has three ships well along towards completion. They are building wooden ships of from 4000 to 5000 tons displacement, reinforced with steel. They have an ultimate capacity at the existing location of four ways and at the present time have installed 250 horsepower with a maximum demand of about 120 kilowatts and an average use of 20,000 kilowatt-hours per month. The present load will undoubtedly be increased in the near future, as there are contracts for which they are now negotiating for additional ships.

Columbia Engineering Works, situated down the river, near Linnton, has been operating for about 12 months, and has a plant for the construction of wooden ships of 3000 tons capacity; three ways are constructed and more are available for future use. The power for this plant is supplied by a steam engine and hence no particular data as to the amount required are available.

Several other companies, recently organized, have only preliminary plans, which are likely to result in the construction of four or five additional plants for the building of wooden boats.

Central-Station Service Used.

Inasmuch as all the above named concerns required the power indicated for shipbuilding within the past 18 months and several of them within the last six months, the facilities of the power companies have been put to severe test to meet the rapidly increased load. But we are informed that Portland Railway, Light & Power Company especially has met the demand by providing increased transformer and line capacities, and has anticipated the future by making additional provisions. That company has installed transformers of the aggregate capacity of 550 kilovolt-amperes for direct shipbuilding service within the past 18 months. There has been a like increase of electric service at six other plants which are engaged in the manufacture of parts and machines for the equipment of ships. One of the plants which doubled its requirement for electric power was an electrolytic oxygen concern, the quickened activities of which were due to the great impetus in shipbuilding.

Applications of Electricity in the Construction of Steel Ships

A Resume of the Advantages of Motor Drive With Details of Two Noteworthy Shipbuilding Plants

THE building of ships is today a matter of national importance and it is but natural, therefore, that serious consideration should be given to any system of power that will tend to speed up production and that insures absolute reliability of operation. These two features are characteristic of electric motor drive, especially where central-station service is used, and although economy is, of course, of secondary consideration under present conditions, nevertheless under the government arrangement of awarding contracts at cost plus 10 per cent ship builders cannot ignore this very important feature of electric operation.

Electricity for light and power is universally used in all of the principal shipbuilding plants. However, the unprecedented activity in this industry is making necessary not only extensive additions to existing yards, but the establishment of many entirely new plants, all of which means that a vast amount of electrical equipment will be needed, and where yards are established within territories served by central-station companies there is an excellent opportunity for the sale of electricity.

The building of steel ships involves a multitude of operations. It would be impossible in the limited space available to comment on the detailed applications of electricity to these operations but a very good idea of the processes involved and the uses of electricity can be obtained from the following brief surveys by two of the important plants devoted to the building of steel vessels.

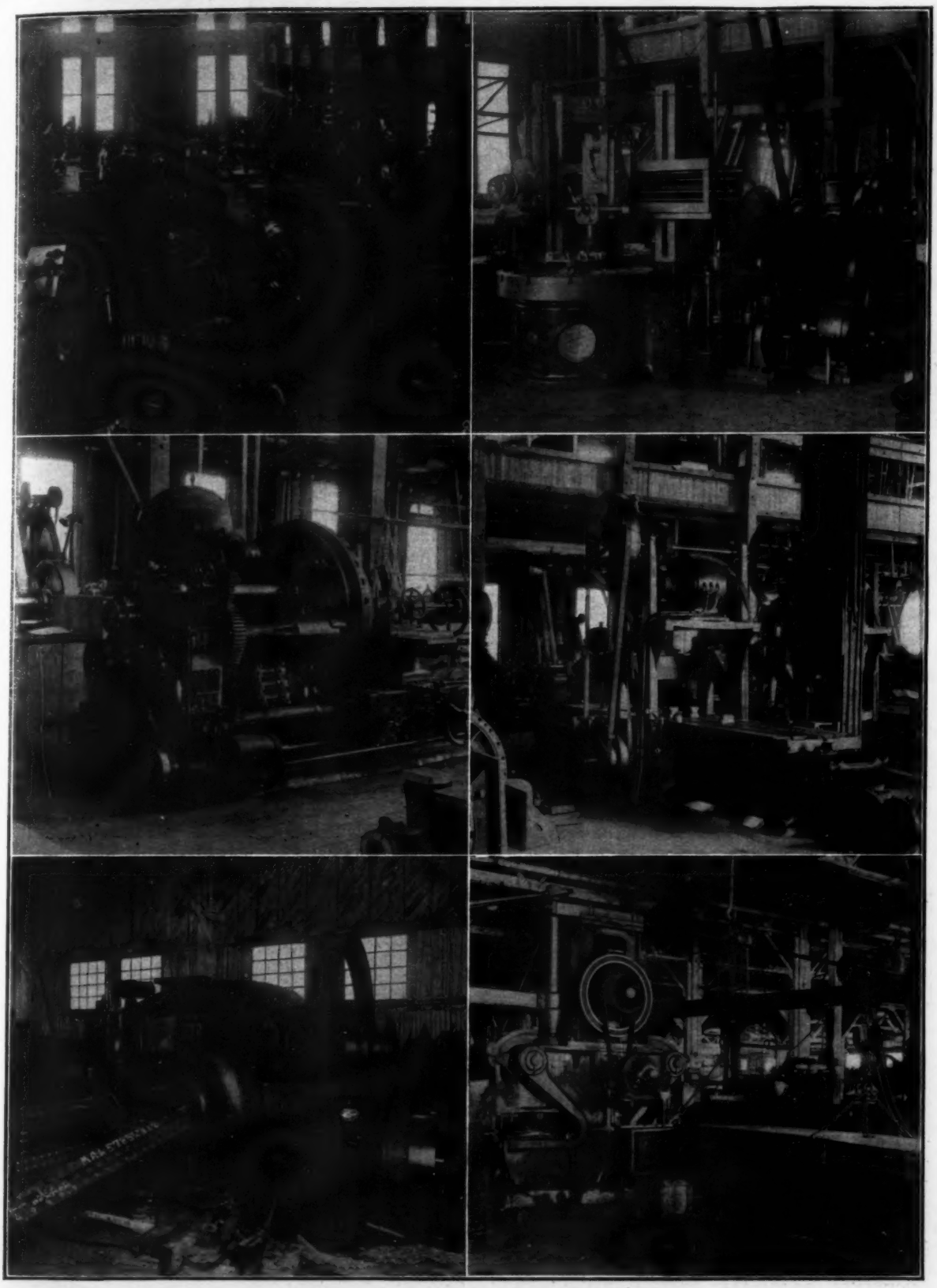
Details of the Fore River Yards.

The shipyard of the Fore River Ship Building Company, Quincy, Mass., has become the most important plant on the Atlantic Coast for the construction of large ships. It would be difficult to find one more completely equipped and embodying more of everything

General View of Motor-Driven Shop at Plant of Standard Shipbuilding Corporation, Shooters Island, N. Y.

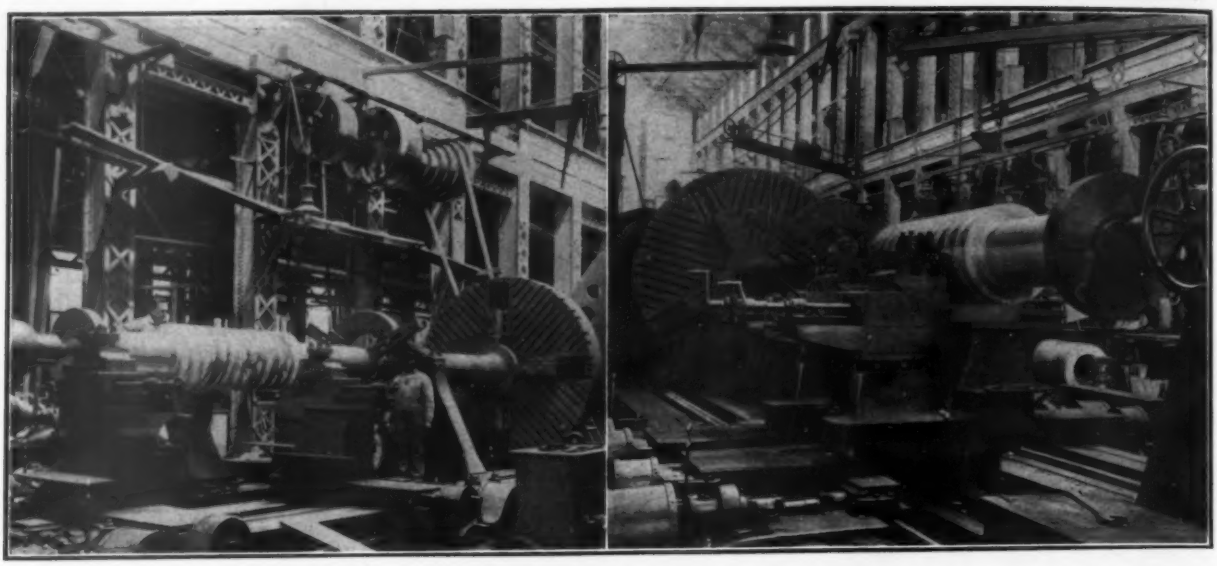
The Electric Crane and Hoist in Shipbuilding Plants.

No application of electricity is of such importance or is more extensively used in shipbuilding plants than in connection with cranes and hoists. Heavy material is used almost exclusively and various unique types of cranes have had to be devised to meet the peculiar conditions in these plants. The above views show a number of different types of cranes in use in a prominent shipbuilding shop.



Machine-Shop Operations in Shipbuilding Plants.

The machine-shop operations in shipbuilding plants do not call for many special applications although heavy machines are the rule. Motor-driven carriers are widely used on large lathes. The accompanying views show a number of interesting motor applications in a shipbuilding plant. Motor drive is used exclusively in this as well as in practically all prominent plants.



Two Motcr--Driven Machines on Heavy Work in a Government Navy Yard.

that is latest and best in engineering practice. Less than 20 years old, it has already contributed notable additions to the navy of the United States. Practically every part of a battleship is constructed within the enclosure. The Fore River shipyard is not the result of slow development. It has arisen almost full fledged without the usual early stages of experiment and trial, the management apparently believing that whatever can be done elsewhere in a mechanical way can be done as well, if not better, in New England. Only the steel and the gray-iron castings are brought into the yard in a semi-finished state. Even the electric equipment of the warships is now being manufactured upon the ground; and the marine engines, both reciprocating and turbine, are built and finished in the shops.

The plant is situated upon ground lying along the Weymouth Fore River, really an arm of Boston harbor and only 10 miles from the city. The area has a frontage approximating two miles. There are buildings furnishing a floor area of nearly 30 acres. Some idea of the magnitude of the works may be gained from the statement that the normal number of men employed is something over 4,000. There are many hundreds of electric motors for driving machine tools, cranes, etc., besides pneumatic shin tools, steam hammers and hydraulic presses.

The most conspicuous structure on the premises is the "ship house," which is merely a huge steel framework for carrying the great cranes commanding every spot of the area inclosed and having a clear lift of about 100 feet, sufficient to carry material to any part of large vessels lying on the stocks within. This skeleton building is 490 feet long by 325 feet wide, and is divided longitudinally into four bays, each equipped with a crane of nearly 80 feet span. The spreading girders are not intended to support a roof; the form is merely due to an economical disposition of material for carrying the cranes.

The ship tool shop, which adjoins the ship house, is a large building containing tools and facilities for shearing, punching and forming plates into sections of a ship's frame or skin. The tools in this building are admirably arranged for convenience in handling plates of awkward sizes and shapes. The floor surrounding each punch and shear is as free from obstructions as possible, even all motors and wires being kept out of sight, and every large tool is surmounted by a swinging crane so that the men have easy access to the work in hand and are free to guide it in any direction.

The main machine shop is remarkable for the number of tools of gigantic proportions which it contains. There are huge lathes for turning the crankshafts of the largest battleships, immense boring mills with revolving platforms flush with the floor, great planers large enough to monopolize the entire floor space of an ordinary custom machine shop, and in the side bays smaller tools of all sizes, for all purposes. In one end of the building the great engines of battleships are set up and fitted, later to be taken down and installed in the hulls of the steamers which they are to drive.

The pattern shop contains a full equipment of the usual wood-working machinery, the upper floor of the building serving as the mold loft where the ships' plates are plotted and outlined. A new blacksmith shop has been added to the plant in the past year. It contains some 40 fires and a full equipment of hammers. A portion of the store building is fitted up for the manufacture of electric equipment for the vessels under construction.

The forge is among the largest in the United States, and capable of turning out the heavy work required in building the largest ships. Propeller shafts and parts of guns are forged under steam hammers. The annealing plant adjoins the forge. It contains oil-burning heating furnaces and vertical cyclindrical annealing tanks for oil baths. There is a saw-mill equipped with large band saws for cutting the timber used in ships, also a brass foundry for casting brass valves and bronze and brass parts. The metal is melted in crucibles exclusively.

The power house, centrally located, is a building 162 feet long by 65 feet wide. There are 6 by 16 feet return tubular boilers set in brick and operated at 150 pounds pressure. The boilers are economically fired, and there are no high chimneys, the Sturtevant system of induced draft being employed. This draft apparatus is, with the exception of the main engines and air compressors, the only steam driven machinery in the entire plant.

For operating pneumatic hammers, drills, caulkers, etc., used in ship work, there are two compressors, one having a capacity of 5,000 cubic feet per minute and

the other delivering 1,000 cubic feet, both being operated by cross-compound engines.

There are about 275 motors varying in size from 0.25 to 100 horsepower. About 75 per cent of the motors are geared or direct-coupled to the tools which they drive. Some of the remainder are belted. There are a number of special motor-driven tools designed to facilitate ship-building operations. One of these is a counter-sinking machine consisting of a motor geared to a drill stock which holds the tool, the whole being mounted on a hand barrow so that the entire apparatus can be rolled by hand over a plate placed in a horizontal position and the tool brought to its work by merely pressing down in the proper positions.

Aggregate Motor Load 3,800 Horsepower.

While the aggregate load of all the motors in the yard is not far from 3,800 horsepower, the average load upon the generators is only about 2,400 amperes for both power and lighting, or about 800 horsepower. The load varies according to the number of tools actually in operation, but the figures here given are a fair illustration of the economy of the system of power distribution and subdivision employed in the yard.

The current is distributed to the various buildings by means of subway and pole lines. The average center of distribution in each building is about 500 feet from the switchboard; each shop has its own set of mains coming through the floor to a distributing board and the feeders are led in various directions to the individual tools. The distributing center of the ship tool shop is placed in a gallery above the main floor where the control apparatus of the various heavy tools is also located. One attendant standing in a position whence he can see the operations going on in any part of the shop works all the machines. This removes all the delicate parts such as controllers and regulators from the machines, where in this particular shop they would be especially liable to injury, to a place of safety. In this shop all circuits are run under the floor and brought to the machines through steel conduits, and there are no exposed wires anywhere in the neighborhood of the machines. In the subway the circuits are run upon rubber-covered cables, manufactured by the Standard Underground Cable Company. These are simply fastened to wooden strips, which give sufficient insulation with the low voltage used and the dry atmosphere of the subway. At the center of distribution in the buildings the line is brought up in enameled "electroduct" tubing, and there the main fuses and switches of the machines are placed.

To the visitor in the Fore River shipyard no one feature is more interesting than the great variety and number of electric traveling cranes used to facilitate the handling of material. The great crane which reaches every portion of the plate yard adjoining the steel tool shop is said to be the largest of its kind in the world. It has a span of 175 feet and travels over 1000 feet of track. The long driving axle is operated by a motor placed in the center of the span. For placing equipment in ships already afloat there are six or more large cantilever cranes and one large folding jib gantry crane which travels the entire length of the 1000 feet fitting-out pier. This structure, which is conspicuous in all views of the yard, has seven electric motors of the build above mentioned. There are three hoist motors; one 25-ton, another 75-ton, and one for the 10-ton falls at the end of the boom. The remaining motors are employed one for crane travel, two for trolley travel and one for hoisting the boom.

In the large machine shop there are cranes of about 80-foot span and 520-foot travel, and in the ship house cranes having a runway the entire length of the structure are capable of lifting weights 100 feet vertically and depositing at any point within the four sections. In the forge and the annealing plants cranes handle the immense ingots, crank-shafts and gun parts with ease. Every shop has some form of overhead lifting apparatus wherever there is an opportunity to save time and muscular energy.

All the large machine tools in which a variation of speed would be desirable are operated on the multiple-voltage system. In the main machine shop there is one of 30 horsepower mounted upon a 120-inch lathe of 108-inch swing; one of 12½ horsepower operating 60-inch lathes; two of 24 horsepower driving 48-inch roughing lathes, and four 8 horsepower operating one 50-inch, two 48-inch and one

Motor-Driven Punch Press on Left and Planer on Right in Newport News Ship Yard.

36-inch lathe. Typical installations in the same shop are: one 50-horsepower motor drives a 16-foot boring mill; one of 24 horsepower on a 120-inch boring mill; one of 15 horsepower on a 72-inch boring mill; one of 2 horsepower on a 60-inch boring mill; one of 9 horsepower on a 50-inch boring mill, and one of 25 horsepower on a 10-foot boring mill. There are motors of 45 horsepower on crank turning lathes, interesting machines on which the great cranks used in large ships are braced against distortion by gravity and the cutting tool travels. There is an 8-horsepower motor for a multiple spindle drill and another of the same capacity for driving an 18-inch slotter. A 25-inch slotter is driven by an 18-horsepower motor and a similar motor drives a milling machine. A cold saw is driven by an 8-horsepower motor. This shop contains a multiplicity of other tools and motors, but those here enumerated comprise only the ones operated on the multiple-voltage system.

In the ship tool shop typical equipment operated on the same system is one 24-horsepower motor driving an angle beveling machine; two of 4 horsepower each drive double-ended shapers; and one of 1.5 horsepower operates a testing machine for bending and breaking strains. In the store house is a 4-horsepower motor for operating a cold saw. In the electric machine shop two motors of 4 horsepower drive a 16-inch lathe and turret lathe respectively. There is one 3-horsepower motor to drive a 30-inch drill press; one of 0.5 horsepower on another drill press, and a second motor of 0.5 horsepower for operating a coil-winding machine designed on the premises.

Electrical Equipment at Ames Plant.

The Ames Ship Building & Dry Dock Company recently constructed and is now operating a plant on West Waterway, Seattle, Wash., for the building of steel freighting vessels and oil tankers.

The electrical installations for power and lighting are completed and in service, current for which is derived from Seattle's municipal plants. Three separate sources of supply are made available to obviate a possible interruption to service. The electrical energy is supplied at 13,000 volts, three-phase, 60-cycles, alternating current, and enters the transformer house where three large transformers step-down the voltage to 2300. Power service feeders are extended to the main switchboard in the power plant; and power feeders on pole lines extend from this switchboard to the several buildings, including the mold loft, machine shop, plate shed and boiler house.

The power plant has three air-compressors, driven by induction motors, wound for 2300 volts. Three 100-kilowatt motor generators, situated in the boiler house, are driven by synchronous motors wound for 2300 volts, these motors having a marked effect in reducing the power-factor of the system. The motor generators produce direct current at 250 volts, which is used for operating the aerial hoists on the slips, the shear legs and traveling cranes in the machine shop, and for charging the batteries on a number of battery trucks in use about the yards.

The energy for power service is stepped down at each building to 440 volts, three-phase, and all motors are wound for this voltage. All machines in the various shops are provided for individual drive, there being more than 150 motors installed, ranging in capacity from one-horsepower to 50-horsepower, with a total connected load of 2000 horsepower.

The distributing panel for lighting service is located in the substation, and separate feeders from it extend by pole lines to each building and group of buildings, such as mold loft, machine shop, copper shop, plate shed, office, gate house, with two separate feeders to the slips. In this the three-wire, 125-250-volt system of distribution is employed throughout.

The mold loft, pattern shop, riggers shop, jointers shop, and others, are illuminated by direct-lighting ceiling units, with high-power nitrogen lamps and special reflectors suitable for each particular case. Bench lights and outlets for wood drills and glue pots are placed at convenient locations. The machine shop illumination represents a radical departure from usual methods. The center span of this building is 50 feet wide, 48 feet high, and contains 17 bays, each 25 feet in length. Each bay has two outlets located under the trusses. At each outlet is a deep-bowl intensive reflector, and a 400-watt nitrogen lamp. In the side wings, each of which is two-stories high, with 13-foot ceilings, four units, each with an intensive reflector and a 100-watt nitrogen lamp, are employed per bay, 25 feet square. By the use of so large a number of units, and with white walls and ceilings a shadowless illumination is produced, and localized lighting is found to be

Motor-Driven Bending Rolls and Plate-Punching Machines in Shipbuilding Plant.

Two Types of Electric Cranes Used in Shipbuilding Plant.

unnecessary, except over benches and directly at cutting tools.

In the plate shed, localized lighting is used, a unit being placed at each punch or shear, and arranged to afford the maximum illumination at the tool employed. The marking-off platform, and transfer platform, at the sides of plate shed, are illuminated by the use of Benjamin elliptical angle reflectors, set 20 feet apart, and so arranged that the rays cross each other.

The general illumination of the slips is accomplished by flood lights located on the masts of the aerial tramways. The working lights are all of the portable kind, about fifty wide-angle flood lights and close to 3000 extensions being used. Plugging in stations for the above are provided in great numbers along the slips and scaffolds. Over 100 flood lights serve to illuminate the yards, and electric heaters are installed in offices of shop foremen.

Each locomotive crane hoist is provided with a steam turbo-generator and an electric lifting magnet. The low-tension service includes a private branch exchange board, with over 50 outlying telephone stations, a complete fire-alarm system and watchman's alarm; and all whistles are electrically operated from the office.

Provisions are made for future extensions of the plant, and the installation as a whole is characterized by devices for the safety of employees and the continuity of the service. All electrical installations were made under direct charge of H. H. Steele, chief electrician for Ames Ship Building & Dry Dock Company, in accordance with plans and specifications prepared by and under supervision of Erwin L. Weber, of Seattle, Wash.

Twenty Wooden Ships to Be Built at Savannah, Ga.—Terry Shipbuilding Company has completed plans for constructing and equipping yards at Port Wentworth, Ga., where 20 cargo steamers, part steel and part wood, are to be built for the United States Emergency Fleet Corporation, in accordance with contracts awarded the Terry company last month. The site selected for yards at Port Wentworth was approved by the Federal Shipping Board. Work on construction of ways, shops, docks and slips is in progress. The vessels are to be of 2500 tons displacement, will be 284 feet long, 45 feet beam, and 20 feet draft. Edward F. Terry, president of the company, is directing the work. This shipbuilding enterprise was financed by William Morris Imbrie & Company, New York, who are interested in the Savannah & Northwestern Railroad. Port Wentworth is on Savannah River, near city of Savannah.

City May Sue Traction Company.—The city of Seattle may bring suit against the Puget Sound Traction, Light & Power Company, to recover $60,917, claimed to be the sum the company should pay as its share of the cost of constructing Fremont Avenue bridge, the alternative being that the company agree to a rental proposal made by the city. The council, at a special session, passed an ordinance offering the company the use of the tracks on said bridge at a rental of $1000 per month, and a charge of one cent per kilowatt-hour for power consumed by the company's cars in crossing the bridge, the power to be supplied by the city. This action was taken on recommendation of Hugh M. Caldwell, corporation counsel, that the city might go on record as having made a definite rental offer to the company; but at the same time a communication from the company asking for another conference is said to have been ignored. The company does not decline to pay an equitable rental, but contends that the rental rate should be determined by competent engineers appointed by the two parties concerned.

The electrical contractors and dealers of San Francisco, Cal., have notified architects and others that after June 11 electrical contractors would not submit bids on work running above $500, except to the owner or his architect.

The North Dakota Telephone Association, in closing its eleventh annual convention at Minot on June 22, decided that the next annual convention should be held at Bismarck, in June, 1918. Officers elected are as follows: President, H. W. Wilson, New Rockford; vice-president, J. P. Smith, Beach; secretary and treasurer, H. A. Awermore, Fargo; executive committee: J. O'Keefe, Cavalier; M. M. Borman, Abercrombie; A. T. Nicklawsky, Hillsboro; A. J. McInnis, Dazey; C. H. Coar, Minot.

Applications of Electricity in the Construction of Wooden Ships

A Statement of the Advantages of Motor Drive With Particular Reference to the Processes Involved

IN CARRYING out the strenuous government program calling for a large fleet of wooden vessels in record time, there is no factor of more vital importance than an adequate supply of electricity. During the past two years, when unprecedented demands have severely taxed the manufacturing facilities of our industries, electricity has demonstrated its worth. It has been convincingly demonstrated, for instance, that motor-driven machines can be operated at their maximum productive capacity, with resultant high shop time-factor; that a motor-driven shop enables one department or one machine to be operated independently of the others; that electric lighting permits night work under conditions approximating daylight, etc. These advantages and many more apply with equal force to shipbuilding plants and are of vital concern.

The tremendous impetus given to the building of wooden ships has virtually created a new industry, as practically all of the important ship yards have long since devoted all their resources to the construction of steel vessels. It has therefore been necessary for the existing yards to make provision for handling this new work, but undoubtedly a majority of the wooden vessels to be ordered will be built by new yards established for the purpose.

It will, therefore, be of interest to review some of the more important advantages of electric drive for woodworking machines with special reference to the processes involved in building wooden ships.

Advantages of Motor Drive and Purchased Power.

There is no question as to the predominating advantages of electric drive for woodworking machines. It has been demonstrated under the severest service conditions that the electric motor renders possible the most economical approach to the direct application at the machine of the total initial power developed.

One of the principal advantages of electric power is the marked reduction in fire risk where central-station service is employed. If power is obtained from an adjacent steam plant the fire risk is great and insurance rates correspondingly high. Mechanical drive necessitates either the dangerous proximity of the boiler room or heavy losses in long steam mains or rope transmission. If central-station service is used, all danger from adjoining power plant is removed.

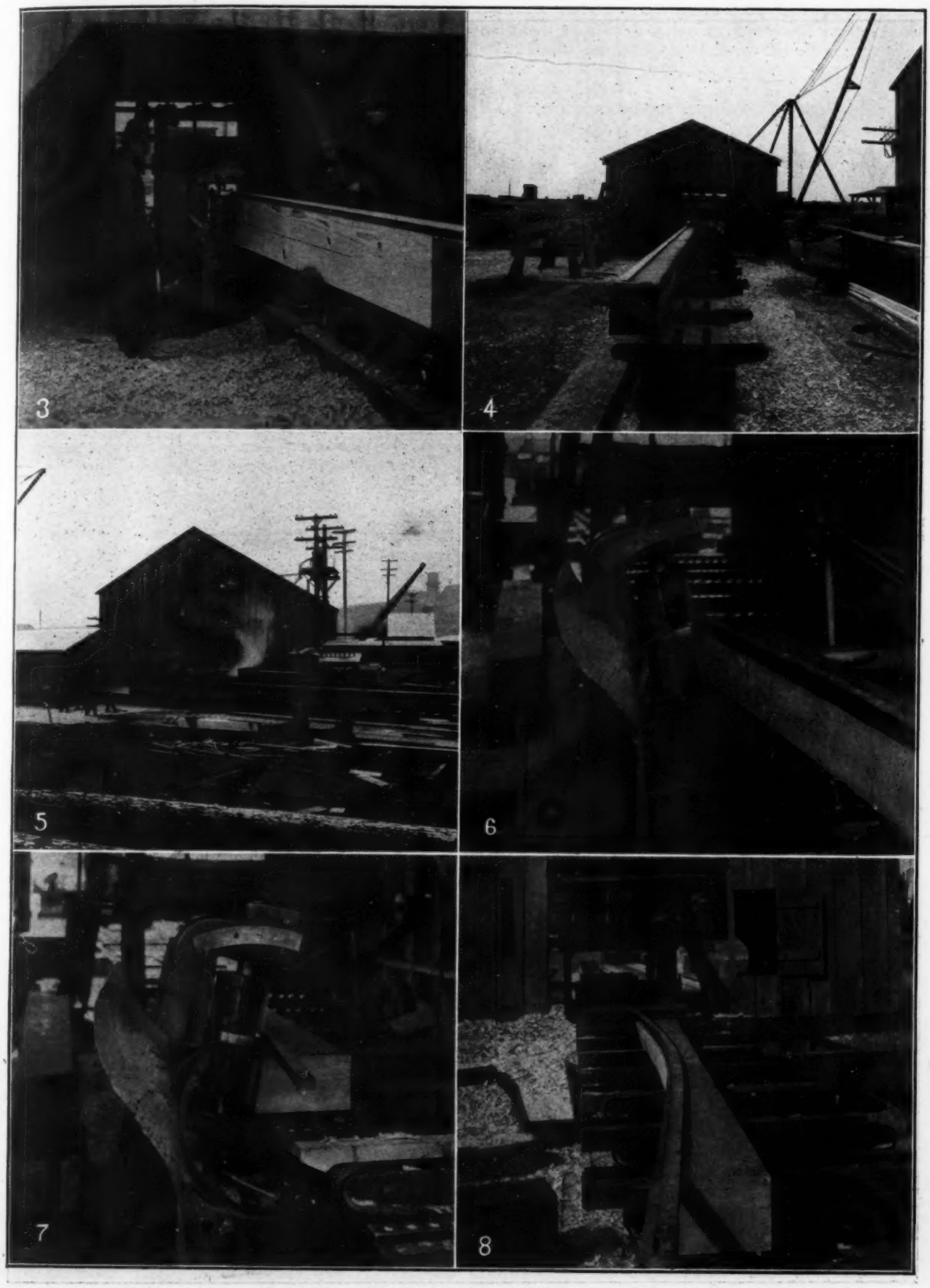
One of the large items of expense in any woodworking plant is that of power. However, it is often erroneously assumed that its unit of cost is very low on account of the wood waste available for fuel, and that consequently there is not the necessity for such economy as is practised in other industries. However, actual experiences of numerous woodworking plants indicate that a ready market can be found for all waste and where the income from this is not sufficient to pay for the entire amount of power purchased from the central station it reduces power bills to such an extent that the cost of steam power, in comparison, is prohibitive.

Selection of Motors.

The selection of the proper motors for driving woodworking machines used in shipbuilding plants is of the utmost importance and should be given the proper consideration by power engineers. If only

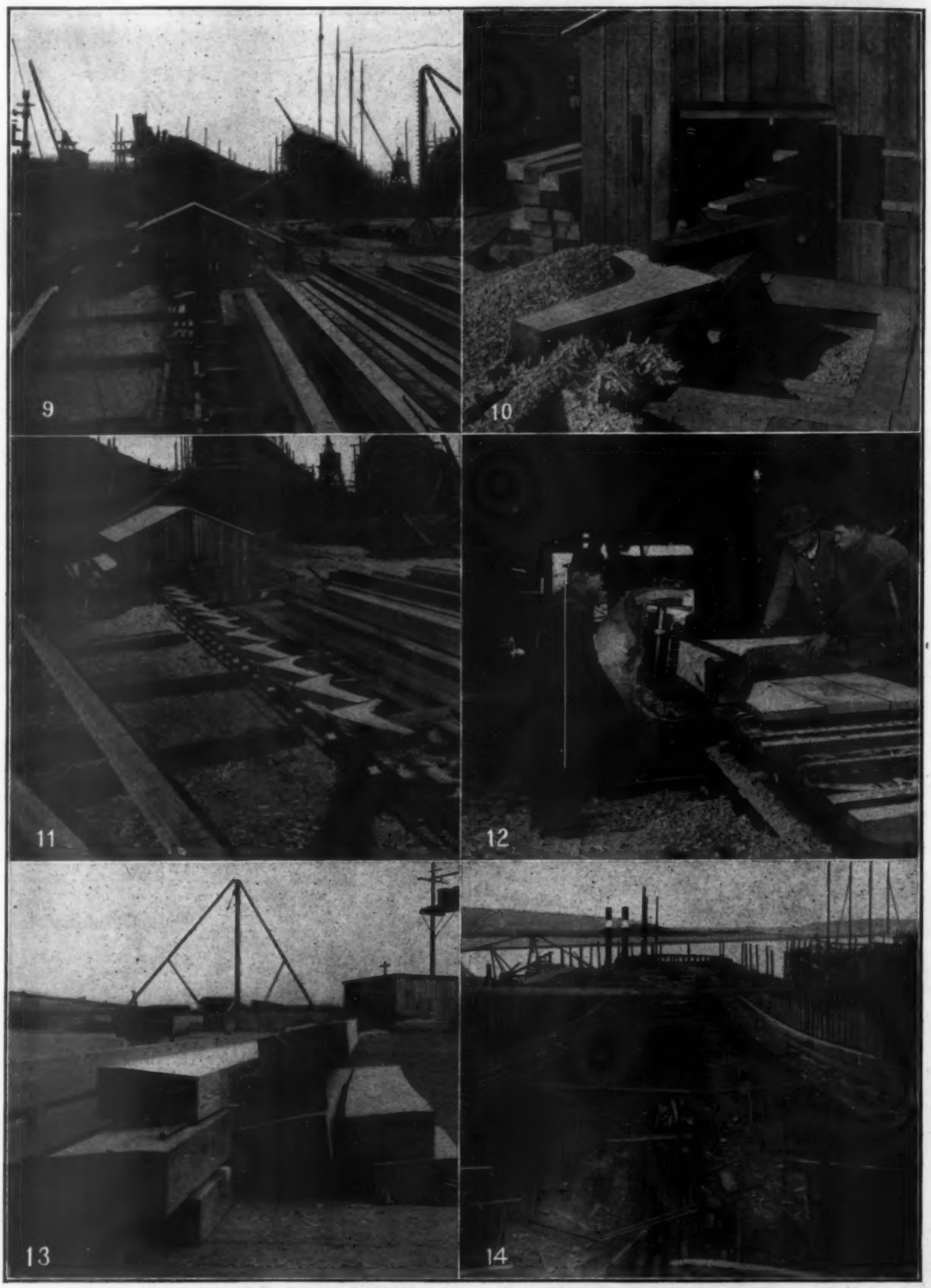
Fig. 1.—Beveling Machine Used in Construction of Wooden Ships.

Fig. 2.—Another View of the Beveling Side-Head Machine in Operation.



Processes in the Construction of Wooden Vessels.

Fig. 3.—Beveling Timber. Fig. 4.—Traveling Bed for Handling Large Timbers. Fig. 5.—Side View of Timber Resting on Traveling Bed. Fig. 6.—Beveling Machine Making a Difficult Cut. Fig. 7.—Side-Head Beveler Making a Reverse Cut. Fig. 8.—Stock After Beveling Process.



Process in the Construction of Wooden Vessels.

Fig. 9.—General View of Puget Sound Ship Yard Building Wooden Ships. Fig. 10.—Operation Known as Surfacing the Knees. Fig. 11.—Another View of Surfaced Timber. Fig. 12.—"Faying the Knees" of Timber With Special Motor-Driven Machine. Fig. 13.—The Beveling of Hatch-Coamings. Fig. 14.—Wooden Ship in Process of Construction.

direct-current supply is available, motors should be compound wound or of the interpole variety, since it is absolutely essential that the motors be capable of resisting the inherently excessive peaks which are apt to occur during the all-day load of the great proportion of woodworking machinery. Direct-current motors should be totally inclosed, except in those special cases where the driving machines are ceiling-suspended away from shavings and sawdust or located in a separately partitioned room, in such a manner as to eliminate fire risk.

Where alternating-current supply is available, the polyphase induction motor with high-resistance squirrel-cage rotor should be specified since the high-resistance rotor permits quick and frequent acceleration and provides the heavy starting torque required to overcome the inherently great inertia of woodworking machines.

Exhaust Blowers.

One of the most difficult loads for the central station to handle is that of the large exhaust blowers which are used to exhaust the refuse from the machines. Depending upon the size of the shop, one of these blowers may take from 20 to 150 horsepower, and the load is naturally constant throughout the working hours of the plant, therefore, the resultant bill, if central-station energy is used, is liable to a serious impediment to the customer's adoption of motor drive.

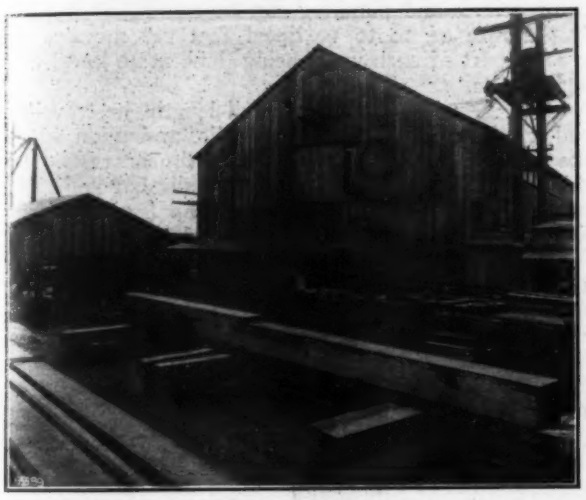


Fig. 15.—Rudder Stock in the Rough as It Leaves the Saw.

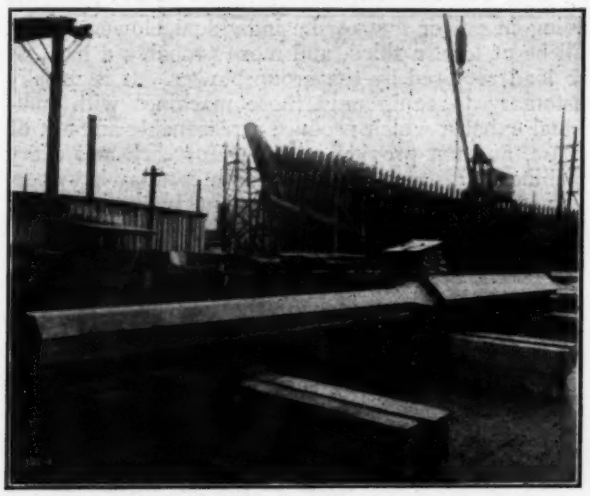


Fig. 16.—Same Stock After It Has Been Cut to Octagon Shape.

The marked economy of individual blowers, however, is becoming so well recognized that practically all new plants are being equipped in this manner.

Because blower systems were at first driven from the lineshafting and were but small, as compared to the total installation, the amount of power used by the system was not made particularly prominent. The mechanical drive system already had a large continuous load, due to the friction of the belts, the lineshafts and the jackshafts, so that the blower load added made but little apparent increase; but, of course, it ate into the fuel pile just as much as though it had been known. When electric motors were applied to the woodworking blower systems, the facts soon became evident, because the motor afforded a very ready means of making a test of the power consumption. Not only was it very evident that the motor was of fair size, but it ran well loaded the entire operating day. In fact, it has been not infrequently found that a three-horsepower motor driving a blower consumed one-third the total power used in a plant with 30-horsepower installed. In other words, the blower used half as much as all the other machines. This is due both to the continuous operation of the three-horsepower motor and to the very short time of operation of all the other motors.

Actual tests on well equipped blower systems have shown that the power consumption is not greatly reduced by closing the gates on all the idle machines. In fact, one test made on a system with over 25 openings showed that with but one damper open and all the others closed, the power was reduced to 60 per cent of the full load. Opening five gates gave very nearly as much load on the motor as opening them all. This shows that while it is highly desirable to have gates, in order to maintain a good vacuum on those openings which are actually collecting refuse, very little reduction in power may be effected even by prompt closing of the gate on every idle machine. It further tends to show that the pipes are in general somewhat larger than necessary, and hence that larger blowers have been used than were actually needed. But as it is necessary to provide for the maximum conditions which may occasionally occur, all the machines operating at the same time, it is difficult, if not impossible, to arrange for much improvement without a complete revision of the system.

But the result of this increased information gained by the application of individual motors to the blowers, has been a recent extension of the individual system to the blowers themselves. Instead of one large blower piped to all of the machines, a number of small blowers may be installed to serve individual machines. Each blower is either belted from the main motor which drives the machine, or it may be operated by an independent small motor, so connected as to start and stop with the main motor. Of course, this system will require slightly more investment in blowers, and in some instances possibly a trifle more in the piping system, for separate pipes must, of course, be run from each blower direct to the refuse bins. Or several pipes may be run to one main which itself is connected to a blower, which prevents clogging of the system where blowers are idle. Also, there may be in some instances some extra cost in the motors. However, the greater investment charges will not be sufficient to affect the real economy in the operating cost. The blowers run only when actually required to move re-

fuse, and hence shutting down a machine stops the power consumption not only of the machine, but also of the vacuum for that machine.

This individual system will be found most economical in such shops as of necessity have an intermittent load. Where a complete routine has been possible, and the great majority of the machines are actually running six or eight hours each day in the week, the individual blower system will not show any decided economy over the group system, and may even be less efficient; but in all mills where the work is largely of a jobbing nature and most of the machines are shut down more than they are running, taking the entire year as the basis the group system will be found less economical than the individual.

It is practically impossible to give actual figures which show the difference made by the use of two blower systems for practically no plant is changed from the group system to the individual system without also making some other change which would affect the power consumption, thereby removing the possibility of making a satisfactory comparison. But it is safe to say that in the great majority of plants, where the load-factor is considerably below 25 per cent, the saving in power due to the individual blower system will be at least a third, and more probably a half, of the load required by the group blower. It is usually customary to equip only those machines with individual exhaust which produce a reasonable amount of refuse, and not provide a blower for each and every machine. This requires a few minutes a day in sweeping around each small machine, but further helps to keep down expense.

Processes of Manufacture.

Through the courtesy of the Stetson-Ross Company, of Seattle, Wash., we are enabled to present in the accompanying illustrations an excellent series of views which graphically show the processes involved in constructing wooden vessels.

In Fig. 1 is illustrated a 20-inch beveling side-head, tilted 15 degrees to the right. Later-built machines, however, are made to tilt 30 degrees to the right. The head is driven by a 7-inch belt, with automatic tighteners on the slack side. The guiding collar, which is clearly shown, is adjustable; that is, it may be raised and lowered to conform to the thickness of the timber to be beveled. The collar is so rounded on the surface that any variation in thickness of the batten does not affect its accuracy in following the line of the bevel. The head is shown fitted with straight knives for ceiling and planking. On the opposite side special knives may be fitted for cutting the calking seams on planking. Knives for cutting the rounded edge of rails also may be used on this head. Cuts as deep as 2½ inches may be taken, the depth of cut varying with the rate of feed.

The beveling side-head, as shown in Fig. 2, is tilted 15 degrees to the left, but later machines are built to tilt 20 degrees to the left. The 48-inch top-beveling head, seen in the back-ground, is shown in a horizontal position. This head may be tilted 15 degrees either way. It is equipped with indicators to show the exact thickness and the angle at which it is set, and may be locked at any angle to which it is adjusted; or, the angle may be changed as required while the timber is passing through the machine. The top-beveling head is square, slotted four sides, and is equipped with one pair of straight knives; for convenience in changing and grinding 24-inch knives are used. On the opposite side of the head, special knives may be fitted for cutting such work as the bead on clamping strips. The top-beveling head is driven by two 5-inch belts, having automatic tighteners on slack side.

Fig. 3 shows bevel-turner at left with his right hand on large hand-wheel with which he easily changes the angel of the beveling side-head as required, while the timber is passing through the machine, the indicator showing exact angle of head.

The guiding collar mentioned under Fig. 1, extends ⅞-inch beyond the cutting circle of the head. A batten, bent and nailed ⅞-inch back of line marked on the timber, serves as a guide for the timber and governs the depth of cut. The timber shown was beveled on a slight angle for a distance of about ten feet, the feed reversed and photograph taken, showing a perfect surface. The man on the opposite side of the machine is placing the pressure roll against the timber directly opposite the beveling side-head.

The machine is provided with a variable, reversible feed, and the rate of feed may be instantly reduced when a deep cut is required and instantly speeded up when taking a light cut. With this machine ceiling and planking can be accurately beveled at the rate of 10 to 50 lineal feet per minute, the greater part of such work being done at 40 lineal feet per minute.

In Fig. 4 is illustrated at full length the traveling bed, equipped with transverse rolls, and upon which the 14-inch by 14-inch by 80-foot timber rests. By this means the largest timbers are easily handled. The pressure roll is shown in its position firmly holding the timber against the beveling side-head.

In Fig. 5 is given a side view of the 14-inch by 14-inch by 80-foot timber resting upon the carriage.

Fig. 6 affords an illustration of the combined beveling, reverse-beveling and curving possibilities of this machine. Before photographing this timber a cut was made for several feet, the bevel starting at 11 degrees to the left, the angle continually changing until it was cutting a bevel 11 degrees to the right.

Fig. 7 and Fig. 8 further illustrate the features explained under Fig. 6. In Fig. 7, the side-head having started to bevel the opposite end of the timber at 11 degrees to left, is shown coming out of the cut at 11 degrees to the right. The result, after being beveled as in Figs. 6 and 7, is shown in Fig. 8.

The illustration in Fig. 9 gives a general view of the ship yards of Puget Sound Bridge & Dredging

Fig. 17.—Rudder Stock After 16 Cuts Have Been Completed.

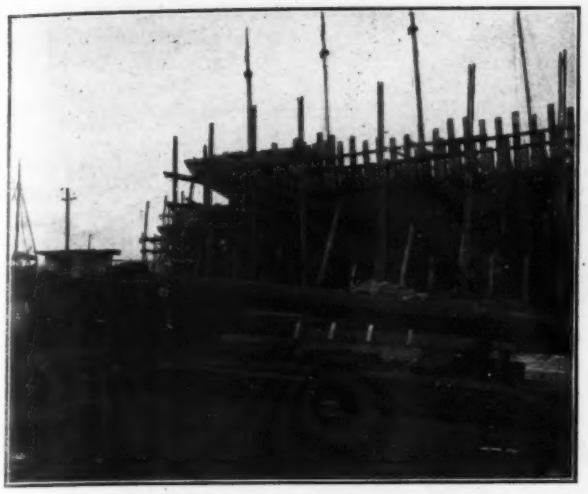


Fig. 18.—Completed Rudder in Foreground—Ship in Process of Construction in Background.

Fig. 19.—Motor Drive in Woodworking Shop of a Large Western Shipbuilding Plant.

Company, with a Stetson-Ross machine in the foreground, showing carriage loaded with knees to be surfaced.

Figs. 10 and 11 illustrate the methods of surfacing the knees, eleven of which are shown after having been surfaced on two sides. The loading and surfacing of two sides of the eleven knees required 15 minutes.

Faying the knees, as shown in Fig. 12, is accomplished by placing a small platform on the carriage and nailing a batten on the knees in same manner as in working ceiling and planking.

The beveling of hatch-coamings is shown in Fig. 13. In this operation the top-beveling head is used, as is also the beveling side-head.

Fig. 14 is an illustration of a ship, in the construction of which no hand tools were used. Every piece was beveled on machines herein described; even the back of the ceiling at the turn of the bilge was beveled.

In Fig. 15 is shown a rudder stock (iron bark) as it appears after leaving the saw and is placed on the carriage of the machine.

Fig. 16 shows the rudder stock placed on blocks sawed to hold it at 45 degrees, the carriage of the machine is run forward and the cutting done on the top-beveling head. As it is especially hard wood, comparatively light cuts are made and each time the carriage is reversed, the top-beveling head is lowered slightly by power (the dial indicator showing the exact position), and another cut is taken.

Fig. 15 shows the rudder stock in the rough as it leaves the saw. Fig. 16 shows the same piece shortly after the work has been commenced in reducing it to an octagon, while Fig. 17 shows the same piece after sixteen cuts have been completed, the lower part beveled two ways, and the sides surfaced.

In Fig. 18 is shown the completed work, after going through the processes described in Figs. 15, 16 and 17.

Will Use Clay for Sealing Porous Banks.—According to J. D. Ross, superintendent of the Seattle (Wash.) Lighting Department, the question of sealing the Cedar River dam, which has caused so much trouble on account of a porous bank, has been solved by the discovery of a clay deposit near the dam. The deposit is said to have a volume of 8,000,000 cu. ft.

ADDITIONS BEING MADE TO LA SALLE (ILL.) PLANT.

Improvements Comprise New 4000-Kilowatt Turbogenerator and 2000 Horsepower in Boilers.

Regardless of conditions, a costly bit of new construction is going on at La Salle, Ill., by the Northern Illinois Light & Traction Company, one of the McKinley plants. An addition to the generating station is being built, and an entirely new boiler house with 250 feet by 16 feet steel stack. Four 500-horsepower Sterling boilers are being added, with D. & W. stokers and a modern coal and ash conveying system.

The present generating equipment consists of one 1200-kilowatt Curtis horizontal steam-turbine unit, one 300-kilowatt Allis-Chalmers turbine unit and one 1500-kilowatt Hamilton-Corliss direct-connected unit. To this will be added one 4000-kilowatt Curtis horizontal turbine unit.

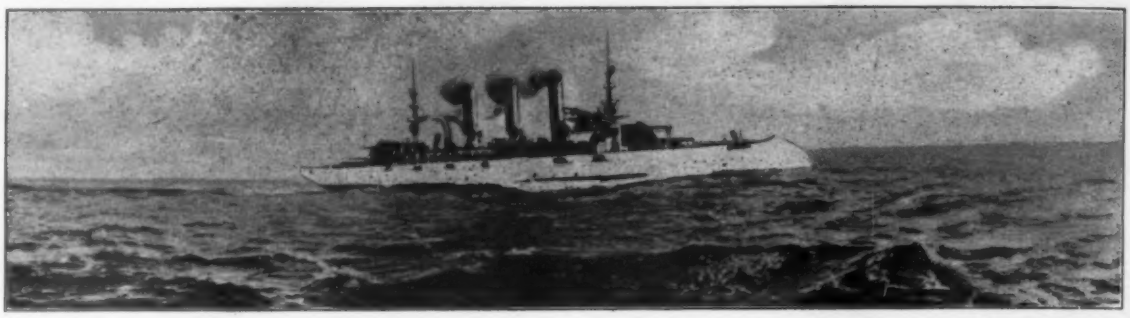
Most of the equipment is already on the spot, with the exception of a 750-kilowatt frequency changer and equipment for a new pump room.

The plant operates in connection with the Marseilles water-power plant. Energy is generated at 2300 volts and stepped up to 33,000 volts for transmission. In general this plant covers the territory from Morris to Spring Valley, Ill. There are numerous coal mines in this district which are electrically operated and get their supply from the La Salle plant, as does also the large cement plant of the Lehigh Portland Cement Company at Oglesby, Ill.

It is quite a problem to make all these improvements without disturbing the present service. There is not a part of the plant that is not more or less torn up and the present stokers are actually working out of doors. It is planned to have every thing completed by the first of December.

The plant manager is J. W. Hess. The superintendent is Charles Hahn, who has his office at Ottawa, and the chief engineer of the plant is L. W. Hess.

Employes of the Public Service Corporation, Newark, N. J., subscribed for Liberty Bonds to a grand total of $670,350, divided in the different departments as follows: Public Service Electric Company, $109,550; Public Service Railway, $172,600; Public Service Gas Company, $88,050.



Uses of Electricity Aboard Ship

A Condensed Review of the Principal Applications of Electricity on Shipboard, Together With Their Marked Advantages for Illumination, Communication, Propulsion and for Other Power Uses

SAFETY, convenience, comfort, efficiency and economy are the chief advantages resulting from the uses of electricity aboard ship and which account for its rapid extension in naval and general marine service. For some purposes, notably for searchlights and for radio communication, electricity furnishes the only medium that can be employed and its use for these purposes has brought about an extraordinary increase in the safety of travel on the seas. For other purposes, such as general illumination, miscellaneous power, heating, etc., electricity is in competition with other mediums and its rapidly increasing employment attests appreciation of its superiority by ship owners and masters.

In order of development, the searchlight is the oldest application of electricity on shipboard, naval vessels being among the first to employ it soon after the arc-light generator came into being nearly 50 years ago. Electric incandescent lighting followed some 15 years later and now is utilized almost exclusively for general lighting on all kinds of watercraft from small pleasure launches to ocean greyhounds and superdreadnoughts. Electric motors came into use for various power purposes gradually, at first on naval ships and later on merchant steamers; now they are employed for a great variety of machinery driving, from electric fans to the main propellers, especially on navy boats. Wireless telegraphy received its first application on shipboard barely twenty years ago. Its progress has been so rapid that now it is in practically universal use on all ships except those making short coastwise runs or sailing on interior waterways. Electric cooking and baking have in recent years been introduced extensively on navy ships where their safety and reliability have won such recognition as to bring about their use on other vessels also.

From this very brief review of the growth of electric application on shipboard it is evident that it has made exceptional progress under the very conditions that at first thought would preclude its use except for minor and incidental purposes. From the power standpoint, a ship is always an isolated plant unless it be a sailing vessel without auxiliary power. It can therefore produce what power it needs direct from its engines; it can utilize oil lamps for lighting and steam for heating and cooking. It is not compelled to employ electricity except for radio signaling and possibly searchlights. The very general use of electricity, which has now become quite common on nearly all ships and is being extended at a remarkable rate, is therefore clearly a most positive proof that it possesses special advantages which it may be well to look into in some detail.

Electric Lighting on Ships

With its hatches tightly closed during inclement weather, the interior of a vessel soon becomes uncomfortably close, and insanitary. Oil, acetylene or other flame lamps add to the vitiation of the air and make conditions still less healthful below decks. They also constitute a continual fire risk. They require very frequent trimming, cleaning and other attention, and at best give an unreliable and unsatisfactory light.

It is not surprising, therefore, that not long after the commercial perfection of the incandescent lamp it came into use on shipboard. This use was at first confined to the higher class passenger steamers and navy ships, but gradually extended so that it is now very exceptional to find ships not equipped for electric lighting, unless they be without power equipment and depend on sails entirely. Carbon lamps were used until some seven or eight years ago, when tungsten lamps came gradually into use, their early fragility retarding their rapid introduction. Now they are employed for nearly all lighting purposes and are replacing the carbon lamps still in use except in those parts of the ship where there is very violent vibration.

The illumination requirements of ships vary greatly, these depending chiefly on the kind of service the vessel is engaged in and its size. Launches, ferry boats, bulk-cargo carriers, packet steamers, excursion boats, fast passenger and mail steamships and the multitude of other classes of marine ships as well as the great variety of naval craft present a wide range of lighting problems. These have been solved electrically so as to meet the different requirements satisfactorily. The actual installations one sees are not always examples of the best practice, but the same is equally true on land.

On a large steamer arranged for carrying many passengers conditions resemble those of a hotel in which there are not only a large number of rooms for accommodating the individual passengers or guests, but also dining rooms, parlors, salons or social halls, smoking and writing rooms where the passengers may gather in numbers for entertainment or social pur-

poses. Besides, there are service quarters, kitchens or "galleys," baggage rooms, quarters for the steamer's officers and crew, etc. All of these are connected by a maze of passageways, halls and stairways, making an intricate problem of the illumination below decks. The problem is complicated by the low headroom nearly always available, except in the large rooms that sometimes extend through two or more decks. In these cases it is possible to employ large units in scientifically designed and yet attractive fixtures, thus securing a very economical and pleasing installation. The difficulties due to low headroom have in some cases been solved by the use of very shallow ceiling fixtures, sometimes by partly recessing fixtures in the ceiling or partitions (the latter especially in passageways), sometimes by the use of brackets on columns or side walls arranged with reflectors to give indirect lighting of the ceiling. Most commonly, however, brackets, dusters or individual bare lamps are employed in a manner that is neither as effective or economical as it might be. It is fortunate, therefore, that the lighting of the passengers' portions of ships is now receiving more attention from illuminating engineers. Excellent examples of good steamship lighting practice are shown in the accompanying illustrations, these having been designed by experienced illuminating engineers.

Many parts of the ship not generally open to the passengers, especially those in the lower levels, require artificial lighting at all times. This is especially true of the engine and boiler rooms, purser's office, etc. Electric lighting of these quarters is the only safe, reliable and economical method available. For such long-hour service the use of tungsten lamps is especially suitable in order to improve the economy over that secured with the carbon lamps still so largely used aboard ship.

Large lamps of the gas-filled tungsten type up to 250 watts are coming into use for the larger machinery and firing rooms with very good results.

On the open decks or other places where the lamps are exposed to the wash or spray of the sea or to considerable dampness or vapor, it is customary to employ weatherproof and vaporproof fixtures. These are of several kinds, but in general provide an outer clear globe tightly and completely inclosing the lamp bulb. As a rule, this globe is protected by a guard to prevent breakage and the globe screws over a threaded extension of a special conduit for similar fitting that constitutes a completely sealed outlet box so that the circuit end of the lamp receptacle is also thoroughly protected. The best types of these vaporproof fittings can be used where no other kind of lamp would serve. These fittings are employed with lamps of 100 watts or less.

For safety in navigation there are required certain so-called running lights, which include red and green lights on the port and starboard sides of the vessel, and white lights on the mainmast. The navigation laws require these to be kept lighted under heavy penalty. Electric lamps have been employed successfully for this purpose by providing them with some safeguard against failure; one means is to place small tell-tale lamps in series with these lights, the tell-tales being installed in the pilot house or other place where an officer is always on duty. These running lights may be only 25 watts or even less; they are provided with Fresnel lenses so they may be seen for many miles.

Among other special uses for electric lighting on shipboard are the illumination of the compass card and navigation charts, lighting of instrument dials, signal dials, and numerous special light signals. In the navy these light signals are numerous and include Ardois sets, night semaphores, blinker lights, searchlights, etc. It is customary, also, to provide a special emergency lighting system for general lighting at important points of the vessel in case the power is all off; this usually is operated from a storage battery especially installed for this purpose.

Searchlights are provided most liberally on navy ships, where they serve not only for military purposes, but also for navigation, for signaling, and for use in docking, coaling and provisioning the ship at night. For the long-range work carbon-arc searchlights are necessary to secure a concentrated and very intense beam of light; powerful searchlights of this type were used for signaling up to 50 miles on clear nights before the advent of radio communication. This method of signaling also can be used for selective signals by day.

For close-range work, such as putting on coal or other supplies, the use of floodlight projectors with concentrated-filament tungsten lamps is proving much simpler and more economical than the arc searchlight. It is likely that such projectors will find much employment on marine craft of all kinds, especially such vessels as make numerous stops during the night in coastwise, lake or river service. Flood-lighting of the docks

Two Examples of Excellent Electric Lighting of Steamships. Observation Room and Dining Room of Steamship Noronic. A Detailed Description of This Lighting Was Contained in a Paper by H. T. Spaulding Presented Before the Illuminating Engineering Society, September 22, 1915.

not only makes for safety, but greatly facilitates docking, loading and unloading.

The first searchlights employed were usually operated from special arc-light generators. It was not long, however, before it was found that they could be run from the generators used for general lighting and other electrical uses, and this is the practically universal rule now. In naval service each searchlight has a special feeder direct from the main distribution switchboard. This is not always the case in marine vessels.

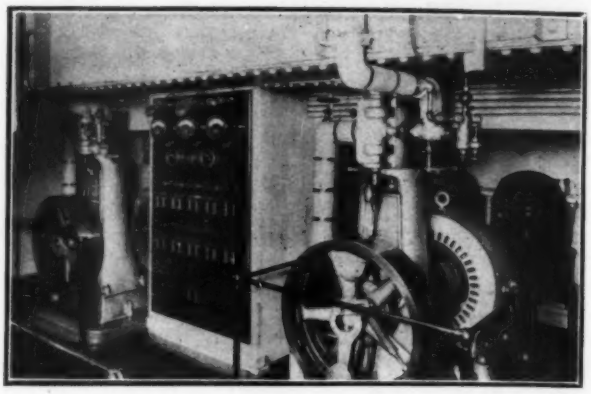
Important developments in powerful searchlights have been made in recent years which have resulted in much more intense, better controlled and more economically produced light beams. These have been due principally to Henrick Beck, of Germany, and E. A. Sperry, of New York. They have given a new impetus to the use of flame-carbon arc searchlights for long-distance light projection.

Wireless Radio Communication.

It is only 20 years ago that the first experiments in wireless communication between a ship and shore were conducted. It took several years before the system was perfected enough to bring about its commercial use on shipboard. Since 1901 the developments have been fast and far-reaching, the range and reliability of radio signals being steadily improved. It was recognized quite early that probably the chief field of usefulness for wireless telegraphy would be as a means of communication between ship and shore stations and between ships at sea. The value of such service was gradually being demonstrated, but it was not until January, 1909, that a most spectacular proof was made of its value in saving life. The steamer *Republic*, after a collision in the Atlantic, succeeded in calling assistance by wireless, with the result that all her passengers and crew were saved before the vessel sank. This event aroused the whole world and soon afterwards legislation was enacted by the leading countries requiring important ships to be equipped with radio apparatus.

Since July 1, 1911, all vessels leaving any American port must be equipped with apparatus capable of transmitting and receiving messages over a distance of 100 miles by day or night. As amended later this applies to all vessels navigating the ocean or Great Lakes and carrying 50 or more persons (passengers, crew, or both), except steamers plying between ports less than 200 miles apart. An auxiliary power supply independent of the vessel's main electric power plant, must be provided and be capable of sending for at least four hours messages over a distance of 100 miles. This auxiliary source of power is usually a storage battery capable of operating the motor-generator for the primary alternating current. An auxiliary engine may be used, however. Efficient and direct communication between the operator in the radio room and the bridge must be maintained at all times.

The installation of radio apparatus on shipboard has had such wonderfully beneficial results that many vessels exempted from the above requirements have been equipped. Safety is the first advantage resulting from such equipment; the vessel is enabled to summon aid in case of accident; it is also enabled to go to the assistance of other ships in distress. It can communicate with its home port and receive instructions from time to time. It can receive and transmit scattered reports of benefit to all shipping. It can provide its passengers with a news service of the events of the day, enable them to send or receive special messages.



Two 10-Kilowatt 115-Volt Crocker-Wheeler Generators Driven by American Blower Engines on Steamer Stradacona. Switchboard Between the Sets.

These are a few features brought about by radio service.

Among notable examples of the value of wireless is the burning in mid-Atlantic of the steamer *Volturno* on October 11, 1913; ten vessels responded to her wireless appeal and rescued 521 persons. Countless other instances of complete or at least partial rescues at sea have occurred and it is no longer probable that a large vessel will be lost without knowledge of the fact at least being communicated to other ships. During the present war radio service has been of inestimable value in fighting the submarine menace. There is every indication that the value of wireless equipment will increase and that practically all ships to be built in the future will be provided with efficient wireless apparatus.

Electric Power for Use on Ships.

The electric fan was one of the first motor applications on shipboard. It required but small current and was found very useful on passenger ships. Use of larger motors developed rather slowly. Naval vessels were among the first to see motors employed in such places where use of a small steam engine would require a long and troublesome length of piping. The application of motors was gradually perfected and their use then more rapidly extended.

On a large battleship there are almost innumerable needs for power for turret turning, gun pointing, ammunition hoisting, operation of water-tight doors and hatches, driving of workshop machinery, refrigerating machines, etc. To supply this power in various parts of the ship through purely mechanical means (shafting, rope drive, etc.) is of course out of the question; to use a multiplicity of steam, hydraulic or compressed-air engines is impracticable because this would require a maze of piping, for which there is no room to spare; to depend on manual power would require a still larger crew—the complement of large battleships already often exceeds 700 men. These conditions made it very desirable to employ electric motors, which are free from the disadvantages of other power sources, and, as the utility of motor drive became more apparent, its use was steadily increased. In the early days of electricity on navy ships lighting formed almost all the load on the generating plant. On modern naval ships, although electric lighting is used exclusively, it forms but a small part of the total load which is now mostly power. In fact, very little power is now used that is not electrical.

Because naval vessels employ electric power on a much larger and more complete scale than any other

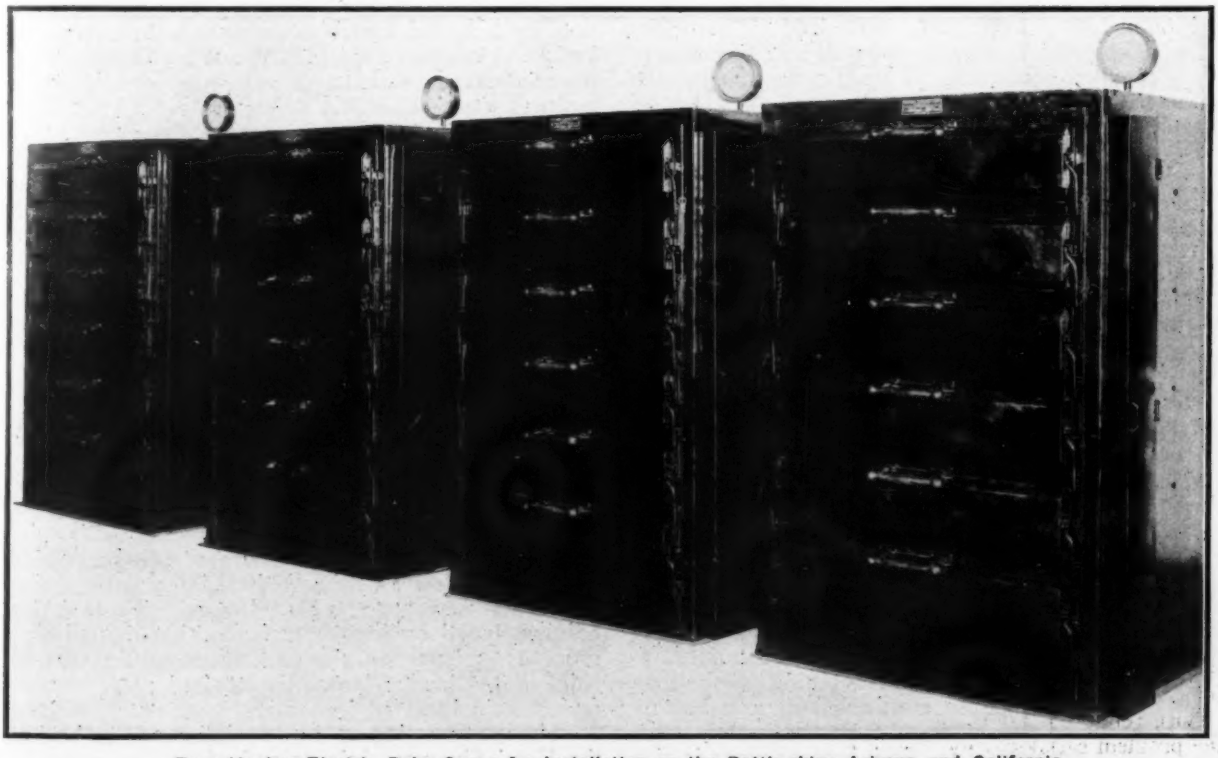
class of steamships, it is desirable to look into their equipment, since the conditions that make for success of electric drive here are also prevailing more and more in general passenger and cargo ships. Aside from purely military purposes (such as turret and gun training, ammunition handling, etc.) motors are used for propulsion, steering, ventilating fans and blowers, forced-draft blowers, coal and ash hoists, bulkhead doors and hatches, air compressors, pumps, ice machines, boat hoists, deck winches, anchor windlasses, printing presses, meat choppers, dough mixers, ice-cream freezers, potato peelers, laundry machines, etc. They are located at various places in the ship and subjected to a great variety of conditions of use and wear. Some are in the lower parts of the ship where they are exposed to much heat, as ventilating motors; others are subjected both to constant heat and dust, as forced-draft and other fire-room motors; some are on deck, where they are liable to be drenched by salt water or rain and then heated by the tropical sun.

The perfection of electric motors has reached such a stage that they can withstand these extremely severe conditions without harm. They are also subjected to heavy electrical overloads, for which they are generously designed. As a rule, the motors are entirely enclosed, being provided with handholes in the casing to give access to the brushgear and commutator. Self-oiling bearings are used, also carbon brushes with fixed positions to require as little attention as possible. Motors exposed to the weather or much moisture are tested for water-tightness by a hose stream at a pressure head of 35 feet which is held 10 feet from the motor; they must withstand this powerful stream without leakage.

All the motors are of the direct-current type, except where electric propulsion is used, for which polyphase induction motors are employed. Shunt, series and compound-wound motors are used, depending on the characteristics of the service for which they are to be employed. Special control equipment is employed in many cases for speed adjustment, reversal and frequent starting and stopping. Electric brakes are quite generally used on hoisting motors.

Electric propulsion of ships was first used for electric storage-battery launches some 25 years ago, but received little consideration until the modern steam turbine came into use on shipboard. Propellers operate at highest efficiency at speeds of 80 to 125 revolutions per minute, whereas the most economical turbine speeds are 2000 to 3600 revolutions per minute. Gear reductions have been used, but in comparison with them electric propulsion has advantages under certain conditions, especially on large battleships or cruisers that must be capable of running economically under wide ranges of speed. With electric propulsion, the main turbine drives a direct-connected three-phase generator which supplies energy to special induction motors that drive the propellers. On a large vessel there results marked economy of room and weight, greater efficiency, and much simpler and more responsive control that is of special value in maneuvering. The vessels equipped for electric propulsion have given excellent accounts of themselves, so that this method of driving is likely to be extended.

On merchant vessels the use of electric motors is by no means as general as it is in the navy, but it is steadily increasing. Scarcity of labor and the need for more prompt loading and unloading are likely to see much more general application of motor drives. Already they are being used for operating winches, hoists and other machinery in place of steam engines whose piping would prove troublesome. On sailing vessels with an oil-engine auxiliary, which are coming into considerable use for cargo haulage, the electric winch is much more advantageous than the steam machine, which requires a separate donkey boiler and is very inefficient and unreliable. Wherever it would be necessary to run long lines of steam piping, with its



Four Hughes Electric Bake Ovens for Installation on the Battle ships Arizona and California.

severe heat losses and troubles due to leakage and liability to freezing in cold weather, it is undoubtedly more economical to install an electric motor. Electrically driven steering gear is proving much superior to the steam-engine gear because of its compactness, elimination of heat and accidents due to leaking or bursting pipes, reduction of vibration and noise, simple control and more rapid response, and greatly increased efficiency.

From the foregoing hasty summary of the uses of electric power on ships it is evident that it can not only meet all requirements, but has many distinct points of superiority over other drives which are bound to see its much more general use on all ships, not those only in naval service.

Electric Cooking and Heating.

One of the greatest hazards on shipboard is fire. Fire drills and fire-fighting equipment are provided for on all ships, but as on shore the prevention of fire is much more to be desired than even efficient fire extinguishment. Many fires aboard ship have broken out in the kitchen where the spilling of grease on an open fire causes an instant blaze that it is hard to put out, even though there may be several cooks at hand. Electric cooking eliminates this hazard.

Other advantages that it possesses for use on shipboard are saving in floor space; cleanliness; elimination of the handling of wood, charcoal, coal and ashes; confining of the heat to the electric range and oven and avoidance of excessive heating of the kitchen; comfortable working conditions for the chef and his assistants; avoidance of smoke and gas; more rapid cooking operations in the case of broiling, frying, roasting and baking, which can be done more speedily on an electric range than on a coal or wood range; more palatable and savory food, because the cooking is under perfect control and not subject to an unreliable fire in the stoves; less waste of food due to spoilage and shrinkage.

These very important advantages of electric cooking aboard ship have been recognized in our navy which employs it very extensively on its latest vessels. Very complete equipments of electric ranges and bake ovens have been installed. On the *New York,* for instance, there are 15 electric ranges and two ovens. In an accompanying illustration are shown four Hughes electric ovens built to rigid Government specifications for installation on the battleships *Arizona* and *California;* each oven accommodates 12 roll pans, two to each of the six oven decks. The connected load of each oven is 15 kilowatts, distributed among seven heating units, each of the three-heat type. The cooking equipment in each case is of the type used in large hotels and institutions.

That the many advantages of electric cooking will result in its use being extended to vessels in general marine service is quite evident. Already some notable installations have been made. One of these was described in an article in our issue of January 8, 1916, dealing with the electrical equipment of the freight steamer *Nevada.*

Electric heating is also finding some employment on shipboard for heating parts of the ship not readily accessible to the regular steam heating system. For instance the wheel house, chart house and captain's quarters are usually on the topmost deck exposed to the inclement weather so that not only would long lines of steam piping be required, but poor heating service rendered. A number of electric heaters solve the problem satisfactorily. Such heaters range in size from 3 to 15 kilowatts, depending on the size of the room to be heated.

Miscellanous Electrical Uses.

In the foregoing condensed review only the principal applications of electricity have been touched on. There are numerous other uses for which it is employed aboard ship with gratifying results. Space permits merely mentioning some of these miscellaneous electrical appliances. One of them is the electrically driven gyroscopic compass, a very ingenious and extremely valuable instrument. Another is the system of interior telephones installed to connect the various parts of the ship with the offices of the captain, purser, steward, etc. A fire-alarm system is almost invariably installed. There are also numerous special indicating and signaling systems, such as a temperature-indicator system for important parts of the ship, helm-angle and rudder-angle indicators, shaft-revolution indicators, engine and boiler-room telegraphs, steering telegraph, water-tight-door telegraphs, besides annunciators, call bells, alarm gongs, etc.

These miscellaneous appliances are all of them small as regards the current used, but they are most of them of great importance to the safe and expeditious handling of the ship. They emphasize the very important part that electricity plays in modern navigation.

WASHING-MACHINE MANUFACTURERS ADOPT UNIFORM ACCOUNTING SYSTEM.

Representatives of 50 Manufacturers Meet in Chicago and Discuss Business Problems.

Seventy-five delegates, representative of 50 different manufacturers, profited by the meeting of the American Washing-Machine Manufacturers' Association, held at the Hotel Sherman, Chicago, June 20 and 21. President Sam T. White of Davenport, Iowa, presided over a session at which some very important business was transacted.

It was decided to make use of the Federal Reserve Bulletins on Uniform System of Keeping Accounts. This will make for particular convenience in applying for credit to banks holding membership in the Federal Reserve System. The question of trade acceptance was also discussed, ending with a resolution favoring their use by every member of the association.

Of special interest to the manufacturers were the reports presented by Raymond March, secretary of the association, who has made several trips to Washington to ascertain the attitude of the government toward the washing-machine industry. Mr. Marsh assured the delegates that the Council of National Defense believes there will be no shortage of materials for the remainder of 1917.

An instructive paper on the subject of billing, invoicing and handling of customers' accounts was read by Howard Power of the White Lily Manufacturing Company, Davenport. Mr. Power expressed his opinion, based on long experience, that there is too great a tendency on the part of manufacturers to ship on too low ratings. He advised more caution and care in handling low-rating accounts.

The next meeting of the association will be held at the Hotel Sherman, July 25 and 26.

Electric Power in Dry-Dock Operations

Electrical Equipment and Operating Characteristis at Dock of Chicago Shipbuilding Plant Is Typical For Installations of this Class—Motor-Driven Pumps An Important Feature

THE dry dock is essentially accessory to the shipyard, and facts concerning its operating equipment fit in well with this issue of ELECTRICAL REVIEW. With the tremendous activity in shipbuilding in this country there comes a corresponding demand for dry-dock facilities. In the distribution of power for operating pumps, driving air-compressors and other purposes, in connection with docking and repairing vessels, electricity is now generally considered the most advantageous and adaptable. As an avenue for the employment of electric power and electrical equipment, the dry docks of the country offer a considerable demand.

In our issue of April 28, 1917, we published an article dealing with electric power in dry-dock operations, from which the following is considered especially suitable for reproduction in this issue.

ADVANTAGES OF ELECTRICITY.

In the operation of dock equipment, electricity has largely come into favor during the last 15 or 20 years, especially as a distributive agent. Its merits of extreme cleanliness and the compactness of working parts, as well as the flexibility of supply, have recommended it as a source of power. While steam engines have usually been used in the past for the operation of pumping equipment of dry docks, present-day practice indicates the tendency toward electric drive. As a motive force, electricity is able to discharge all the functions of steam for running machinery identical in character. Electricity is admirably adapted to systematic distribution from a central source, and the cost of wire mains is much less than that of any corresponding pipe system.

Since steam is usually employed for the generation of electricity it cannot be contended that the use of the latter is more economical than the use of steam, but it can be pointed out that one large electric generating station, using steam-driven prime movers, involves less expenditure in fuel, repairs, maintenance and attendance than a number of steam engines, each with its special outfit and upkeep. Moreover, the electric generating plant finds additional use at night for lighting purposes. Electric power in its particular application to dry-dock equipment has the advantage over steam or other kinds of power because of the simplification of construction and methods of operation of the pumping units. The use of central-station service involves numerous considerations in its application to dry-dock and shipbuilding operations, and these will be discussed later, after data has been given on the use of such service in a particular instance.

LARGEST DRY DOCK ON GREAT LAKES OPERATED BY ELECTRICITY.

During 1915 the Chicago Shipbuilding Company, a branch of the American Shipbuilding Company, of Cleveland, O., erected the largest and what is con-

View of the Pump House and Transformer Equipment at Chicago Shipbuilding Company's Dry Dock in South Chicago.

View of Pump House and Entrance Gate from Wall of South Chicago Dry Dock.

Pumping Out a Dry Dock—Discharge from the Motor-Driven Centrifugal Pumps.

ceded to be the finest dry dock on the Great Lakes. The dock was built at its yards in South Chicago, Ill., and can receive the greatest ships which float on the lakes and still leave room at bow and stern. It is 723 feet long in its center line, has an inside beam of 103 feet and has a normal floatage draft of 16 feet 6 inches, or 2 feet more than the light draft of any Great Lakes ship. The dock is built of solid concrete and fronts on the Calumet River about a mile from Lake Michigan, making it practically unaffected by wind, water levels and storms.

The operation of the dock is completely governed by electricity and central-station service is used, energy being supplied by the Commonwealth Edison Company, of Chicago, from its substation at South Chicago. During the construction of the dry dock a submarine cable was laid across the river to furnish power for some of the building operations and the service lines were made permanent for operation when the dock was finished. Energy is supplied at 4000 volts, three-phase, 60-cycles. The lines feed through three 150-kilowatt transformers, erected on a pole structure outside the pump house, and which reduce the pressure to 220 volts for light and power.

Electrical Equipment of Pump House.

The pump house is located near the entrance to the dock and contains all the equipment for the electrical control. It is built of concrete, 24 by 300 feet, one story and basement. There are two main pumping units, each consisting of a 200-horsepower, 220-volt, squirrel-cage vertical motor driving a Wheeler 30-inch centrifugal pump capable of delivering 30,000 gallons of water per minute, and running at approximately 287 revolutions per minute at full-load speed. These motors are started independently and at the time of starting the pumps are operated under zero head, in which condition the motors are loaded to approximately 125 horsepower. They are controlled by automatic starters.

For the purpose of pumping out the water that leaks through the entrance gate when a ship is being repaired there is installed a 40-horsepower, 220-volt squirrel-cage vertical motor driving a Wheeler 12-inch centrifugal pump with a capacity of 4000 gallons per minute, operating at approximately 690 revolutions per minute at full-load speed. This motor is controlled by an automatic float-operated switch, the latter device being stationed so that when the leakage-water level reaches a certain stage the switch is automatically closed to operate the motor-driven pump.

The pump tubes connect with a tunnel, 7 feet deep by 8 feet wide, that runs the width of the dock just inside the entrance gate. There are three openings from the floor of the dock into the tunnel, one 10 feet square in the center, and two, each 5 feet by 3 feet, at the sides, all the openings being covered with screens to keep foreign matter from entering the pumps. By way of explanation, it may be stated that the center opening is of large size to allow workmen more room in which to work on a rudder, ships always being placed so the rudder is immediately above this central opening. The screens are removed, permitting easy access for the removal of a rudder or for similar work.

The entrance gate, which is a floating caisson, is a steel structure, made up of riveted plates and bracing interior construction, in a shape very similar to a ship. When the dock is closed the ends and bottom of the gate rest against sills at the sides and bottom, the bearing parts of the gate being provided with wooden strips to make the joint as tight as possible. When a ship is ready for entry into the dock, the gate is floated by means of a 2-horsepower induction motor that operates to pump water out of the compartments in the structure. The gate is then floated out of the way, and after the ship has entered it is returned to the entrance and sunk into place by the admission of water through four 3-inch valves into the compartments.

After a ship has been centered so that it will come to rest on the blocks, pumping is started. With both large pumps operating it takes about 3 hours and 30 minutes to empty the dock, tests having shown an elapsed time of 3 hours and 6 minutes when a large boat was docked and 3 hours and 40 minutes for a complete pump-out. In the first case the energy used was 795 kilowatt-hours, and in the second case 1080. The cost for energy is about $75 per pump-out, and about 20 pump-outs are made per year. Five 36-inch valves in the entrance gate are opened to admit water into the dry dock for floating a ship.

Service for lighting is supplied from the central-station company's mains, lamps being installed in the pump house and basement. There are 14 outlets installed on the coping of the dry dock, these being spaced about 100 feet apart. Flood-lighting units and clusters of 6 incandescents are plugged in for illuminating a ship being repaired at night.

The original plans for the construction of the dry dock called for the installation of steam-engine-driven

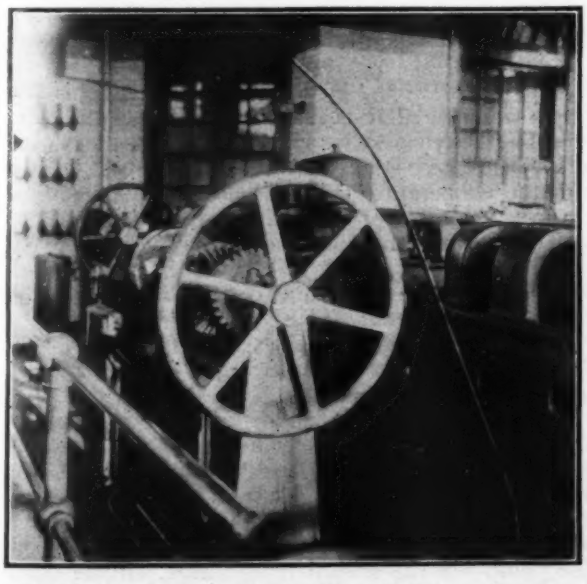
equipment for pumping, and the engines were also to drive an air compressor, this form of power being used throughout the yards for small hoists, riveting hammers and other tools. It was believed that economies could be effected by the use of steam power, and the installation of a new plant at the dry dock offered an opportunity for the installation of additional steam equipment that would make the entire power installation adequate and complete for regular and emergency uses.

However, looking forward to the complete electrification of the yards, the central-station company was able to secure the installation of its service by offering a contract for the use of energy for pumping on its limited-hour schedule, during the off-peak periods. Other features of central-station service emphasized by the company were (1) reliability of service in the continuity of supply; (2) readiness to serve, having at all times full capacity for instant use; (3) flexibility, enabling the installation of additional equipment or a change of shop location; (4) elimination of generating plant investment, with accompanying fixed and maintenance charges; (5) utilization of space and the obviation of executive supervision.

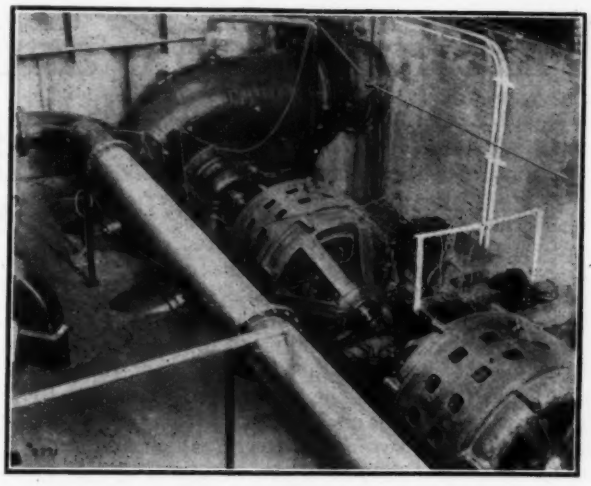
The problem of providing additional air-compressor equipment was solved by the installation of a motor-driven machine in the pump house. This is an Ingersoll-Rand compressor belt-driven by a 152-horsepower squirrel-cage induction motor. This compressor is used as auxiliary equipment and is not operated when the dock is being pumped out.

The pumping equipment of a number of European dry docks of about the same size as the South Chicago dock is considerably larger, and the time for pumping out is correspondingly reduced, in one case being as low as 2 hours. The reason for not following European practice was that the installation and maintenance costs do not warrant the installation of the more powerful equipment.

The character of the service being intermittent—about 20 pump-outs a year—the demand charge for central-station service would be exceedingly high. In the plant in question the demand is only the capacity of the two main pumping motors, since the sump-pump motor and the compressor motor are never operated during pumping operations.



Motors and Pump Mechanism for Dry-Dock Installation.



Motors Driving Centrifugal Pumps Supplying Dry Docks.

A BOOKLET ISSUED DESCRIBING JOVIAN INSURANCE PLAN.

Full Details Prepared by Mercury Bennett for Information of Members.

The Jovian central office has issued for free distribution a comprehensive brochure completely covering every phase of the accident and health insurance the order is now furnishing its members. The booklet is written by Mercury Ell C. Bennett, and is entitled, "Smack—in the Bull'e-eye!" The plan was described in our issue of June 9.

The announcement is made on the title page that it contains "Condensed Data Prepared for the Busy Man to Cover Briefly But Completely All Important Features." The subject matter is divided into seven chapters, headed respectively: What It Means in Money to You, The Proposition in a Nut-Shell, How the Saving Is Made, The Company Back of the Policies, The Policies, How to Make Application, and The High Points Spot-lighted.

Among the outstanding statements in the booklet is that to the effect that Jovians are enabled to secure this insurance at approximately one-half what it would cost through any other source.

It is pointed out that the saving is made possible due to the fact that the Jovian central office, as a direct service to members, is taking the place of general and sub-agents, and is taking care of office and collection details without charge. Thus the insurance is going direct from the source to the purchaser stripped bare of every middle-man's overhead and operating expense and profit.

Another statement that is emphasized is that referring to the fact that every cent of the saving made is going to the membership; that neither the Jovian central office, the local leagues, nor any of the Jovian officers are retaining, for the effective services they are performing, one penny of the amount paid in premiums by the insured.

It is further stated that this service is a complete fulfillment of the promise of the Order to give its members more tangible benefits because of additional facilities supplied by the increase in dues, which took effect this year.

The booklet may be obtained upon request made of the Jovian Order, Syndicate Trust Building, Saint Louis, Mo.

Practical Cable and Insulator Problems

Special Meeting of American Institute of Electrical Engineers Considers Such Matters as Deal With High-Tension Cables and Insulators, Mining, Water Power and Transformers

IMPROVEMENT in operating conditions of electrical transmission and distribution equipment so as to withstand the increased loadings now imposed and minimize the liability to breakdowns formed the principal theme of the discussions at the special New York meeting of the American Institute of Electrical Engineers held on June 27 and 28. A condensed summary of this two-day meeting, which replaced the usual annual convention of the Institute, was given in our last issue. Eleven papers were presented and discussed and special addresses were made by President Buck and President-elect Rice.

Below are given abstracts of the four papers on cables, which were the first ones presented:

Problems of Operation and Maintenance of Underground Cables.

In this paper John L. Harper states that the scarcity and high cost of transmission materials demands that the transmission capacity of underground cables be increased to a maximum. Assuming the cables to be of good design, material and workmanship, the fundamental causes of cable failures are: joint troubles, mechanical injury to lead sheaths, and overheating. Poor joints are due to improper workmanship, poor material or inexperience, and also to a large extent to use of joint-filling compounds that have not the same characteristics as the insulating compound used in the cable itself.

Overheating is the principal cause of cable breakdowns on large power systems operating at high load-factors such as those at Niagara Falls, with which Mr. Harper is associated. When the heat developed in the conductors through constant working at full capacity has little chance to dissipate itself, the cable temperature will steadily rise to a point where the insulation will deteriorate and ultimately break down. This suggests that means be developed to dissipate the heat more rapidly, as by placing porous tile outside the conduit so as to dampen the earth. Mr. Harper suggests that this dissipation be by water in new construction, conduit systems being flooded and operated under practically submarine conditions. In this way the double carrying capacity of aerial cables could be more nearly approached.

The Fundamentals of Successful High-tension Cable Joints.

The varying standards and methods used in making joints of high-tension cables result in great differences in the cost and time required to make them, these ranging from $5 to $30 and from half to one and a half days per joint. To secure standardization of this matter, the author of this paper, D. W. Roper, suggests the following specifications for joints of cables for 20,000 volts or thereabouts:

1. The cable sheath should be cut back from the ends of the conductor a sufficient distance to allow the application of the insulation to the joint without injuring the insulation around the conductors.

2. The copper splicing sleeves should have a carrying capacity at least equal to that of the conductors.

3. The ends of the copper splicing sleeve should be carefully tapered, rounded and finished so as to eliminate all sharp points or edges.

4. The conductors should be separated from each other and from the inclosing lead sleeve by some form of solid insulation that will hold them in a fixed position relative to each other and to the inclosing lead sleeve.

5. The filling compound should have sufficient dielectric strength, which should not be materially reduced at the maximum operating temperature of the cable. a. It should be nonhygroscopic. b. It should not form cracks in cooling nor during cold weather. c. It should be sufficiently fluid when poured so that it will flow into all air spaces before becoming chilled. e. It should be capable of being readily removed when necessary without injury to the insulation around the conductors. f. It should not have an excessive coefficient of expansion.

6. The insulation should be applied and the compound poured in such a manner that the joint will be without air pockets or voids.

7. All moisture should be carefully excluded from the joint.

8. If filling compounds with low melting point are used, precaution should be taken to prevent the compound from running back into the cable at the maximum operating temperature.

9. The initials, or some other symbol, should be stamped on the joint to indicate the name of the splicer.

10. The joint should be so located, supported and protected that it cannot be readily injured by men working in the manhole.

Influence of Dielectric Losses on Rating of High-tension Underground Cables.

This paper by A. F. Bang and H. C. Louis describes a series of tests made at Baltimore to determine the dielectric losses in various kinds of 13,000-volt cable. These losses were found to increase greatly with the temperature and thus become an important factor in the rating of such cables. A method was developed whereby the influence of these losses on the rating can be approximately calculated for duct lines with uniformly loaded cables as the result of these tests, the authors propose.

1. That high-tension cables always should be purchased under certain guarantees as to dielectric losses at various temperatures.

2. That for determining the load-carrying capacity of a given high-tension duct line the critical temperature should be investigated and the rating made so that the highest copper temperature (under steady load conditions) always would remain a definite number of degrees centigrade (say 10 degrees centigrade) below this point. If the critical temperature, on the other hand, is found to lie so high that temperatures lower than this may be destructive to the installation, these

naturally would govern; but in such a case the same temperature should be considered permissible for high-tension cable as for a low-tension cable.

Insulation Characteristics of High-voltage Cables.

W. S. Clark and G. B. Shanklin in this paper discussed the insulation characteristics of different types of single- and three-conductor cable, determined largely by dielectric energy loss measurements. Particular attention was given to paper-insulated cable, both new cable and cable that had been in service being considered. Varnished cambric and different grades of rubber insulation, as well as cable compounds, were also dealt with briefly. It was shown that most cable breakdowns are due to overheating at special "hot spots." The losses in the dielectric increase quite rapidly with the temperature and serve as a vital limiting factor in cable rating. The widest variation in insulation characteristics was found in paper-insulated cables, which are the most commonly used. Varnished cambric was found to have superior characteristics to paper insulation; it is more uniform and stable.

Discussion on Cables.

Discussion of these four papers was opened by W. I. Middleton, who said he was convinced that the personal element enters into the making of a good joint probably more than any one other thing. Some of the most successful cable splicers are making what might be called a very unscientific joint without any of the new ideas that have been advocated recently, depending almost entirely upon the quality of material used and the quality of the workmanship. When the insulation of a cable is subjected to an electrical pressure the material is electrostatically strained by molecular displacement, which may end in rupture if the pressure prove sufficient, but if the pressure be removed before breakdown occurs it will, in most cases, gradually recover its normal condition, and the ability of a cable dielectric to withstand this strain or to recover from such strain is important when used on alternating-current circuits.

Chester L. Dawes mentioned that there was a phase of practical operating conditions which Messrs. Bang and Louis had overlooked. In most central stations the peak load exists only for perhaps a half hour, and owing to the heat-storing capacity of the cable and its surrounding it is almost always possible to force a cable considerably in excess of its normal rating for such short periods. The making of cable joints has always caused operating companies considerable trouble. He believed that some of the difficulty in obtaining good cable joints is due to the fact that the ordinary cable splicer is a "practical" man and perhaps a very good workman, but he does not appreciate the many seemingly negligible factors which have a very important bearing upon the dielectric properties of insulating materials. Among these is the exclusion of air and moisture and also the elimination of all sharp points and edges in the metal of the joint.

Philip Torchio, while commending the value of analytical papers, pointed out the danger of generalizing too much. For instance, it would be useless to make a comparison of a No. 0000 cable which carries 38 amperes with another cable of the same capacity which carries 127 amperes. Cables may be installed in different levels and in different ground conditions, with resulting inequalities in the dissipating properties of the soils. All of these conditions may cause a greater distortion and a disturbed condition of the duct structure and affect the cable insulation and must be considered in making comparisons.

Charles W. Davis mentioned that a number of difficulties were met with in the early days of the manufacture of cable made with the mineral base compounds. Most of these difficulties have been overcome and the other troubles in cable making in the course of time and under longer observation have proven less serious in practice than had been imagined. It has only been within the recent past, however, and after a number of years' experience with such cables, under actual working conditions in widely separated parts of the country, that it has been deemed wise to offer such cables on a more extended scale. There is one particular in which present-day practice will need modification. That is in connection with insulation resistances. Cables are composed of such ingredients that while having a relatively high hot insulation resistance, they have a relatively low cold insulation resistance.

Harry R. Woodrow said that the need of improving the methods of making cable joints was recognized several years ago and extensive studies and tests with different kinds of joint-filling compounds were conducted in connection with different types of carefully made joints, but all these joints failed to give uniform and satisfactory results. Paraffin compounds were found unsatisfactory because on cooling they contract, leaving pockets. Heavy gum compounds with high melting points did not flow into the crevices, and under short-circuit stresses they cracked. Experiments were also made with liquid fillers, such as rosin or mineral oils used in the insulation of cables, but the difficulty with these is that they run into the cable and leave voids in the joint. This difficulty was overcome by wrapping insulation over the sleeve of the joint, and then over that a covering of cotton, which holds the oil in the joint, and even after the oil had been drained out of the sleeve this joint withstood the test better than any other compounds that had been found.

John B. Whitehead remarked that the dissipation of heat from a conduit line takes place by heat conduction. Under these circumstances the temperature that is contained in the conduit line depends on the temperature gradient of the surrounding medium. In the papers under discussion it is assumed that there is a definite temperature gradient around each conduit line, and that being the case it accounts for the straight-line relation between the losses in the cables and the resulting temperature. He mentioned this in the bearing it has on the indication that the cross-section of conduit line is just about the worst that could be chosen. The paper of Bang and Louis is a distinct step towards the very desirable position of being able to rate cables definitely. The rating of a cable requires, however, in the method suggested by them that the heat-dissipating curve of the duct should be known, and for that is needed a knowledge of the properties of the soil and the losses that are taking place in all of the ducts except the particular one in which the cable in question is laid.

Edward B. Meyer believed that the most important factor entering into the making of a satisfactory joint is the education of the splicer. The Public Service Corporation of New Jersey had had much trouble with joints, and about five years ago worked up a careful set of specifications covering this work. Thereby joint-making methods were considerably improved and very much less trouble is now met on that account.

Claude N. Rakestraw mentioned the electrolytic failure as one of the most frequent. Electrolysis

trouble is one which the operating engineer always has to fight in the large cities, and is one of the most difficult to control. He thought in regions where electrolytic injury of the lead sheaths is apt to be present the submerging of cables in water is likely to accentuate the trouble, and not only to aid in the destruction of the sheath, but once an opening has been made in the sheath to admit water and complete the destruction of the cable.

There was the usual closure of the discussions by the authors.

Three papers on insulators were then presented as abstracted below:

The Insulator Situation.

In this paper W. D. Peaslee shows that there has been a gradual rise in the requirements held essential to a successful insulator. Tests made indicate that the rapid deterioration of insulators, even when stored away, is due to four chief causes: Mechanical stresses due to temperature changes; dielectric flux concentrations due to defects in the porcelain or improper designs; similar concentrations due to the porcelain being made up of two materials of widely different properties; mechanical stresses due to differences in the co-efficients of expansion of the porcelain constituents. The author's conclusions are as follows:

1. The porcelain insulator as commercially available today is not a success, it is deteriorating too rapidly both in and out of use and the gathered evidence points to certain inherent features of manufacture and composition that are responsible in large part for this unreasonable deterioration.

2. The design features may be overcome by a correct appreciation of the mechanism of breakdown and the application of correct principles of dielectric flux distribution.

3. It has been found possible to make and manufacture fused quartz on a laboratory scale and indications are that it can be done on a commercial scale for a permissible price, and it is hoped that the development of this and other studies now being made by many engineers may lead to a lessening of the enormous cost of the present insulator depreciation encountered by operating companies.

Expansion Effects as a Cause of Deterioration in Suspension-Type Insulators.

In seeking causes for the rapid deterioration which has been encountered in suspension-type insulators, two leading hypotheses, viz., porosity and mechanical cracking through expansion effects, have been advanced by different groups of investigators. These are briefly outlined in the paper by J. A. Brundige, after which the author presents data in support of the latter. Some of the operating problems attendant upon insulator deterioration are also discussed. The author's conclusions are as follows:

1. The conditions existing inside the metal caps are sufficient to explain, through temperature expansion alone, much of the trouble experienced. Expansion occurring in the cement because of moisture absorption is of an even more serious nature.

2. No evidence of importance is at hand showing that electrical stresses have caused the trouble under discussion.

3. Except for bad cases of underfiring, which are generally easily detected, losses of insulators in service do not bear any apparent relation to the degree of firing.

4. So far as observed, deterioration takes place quickly, such as would be expected during the formation of cracks. On the other hand, slightly porous ware absorbs moisture only very slowly, and were porosity the predominating cause for failure, large numbers of units would undoubtedly have been discovered in the intermediate resistance stages.

5. Cracks of more or less long standing have been identified in a majority of cases where it has been possible to carry on post mortem examinations on defective insulator units.

6. The relatively good showing made over long periods by pin-type insulators having cemented parts and by Hewlett units, none of which represent as high development of the porcelain manufacturer's art as some of the later suspension insulators, would indicate that porosity is not the factor of most immediate concern.

Present Practice in Design and Manufacture of High-tension Insulators.

As considerable time or a severe condition is necessary to show up serious insulator defects, the favorable line conditions on the earlier lines permitted the use of inferior material and designs, said A. O. Austin in his paper with the foregoing title. The apparently satisfactory operation of inferior insulators together with the large production necessary did much to retard improvement in the insulators, for improvement was practically impossible unless same could be accomplished without materially increasing the cost.

The desire to increase production and improve the material necessitated radical changes in the manufacture and equipment, so that the well equipped plant today is far different from the ordinary pottery which it resembled a few years ago.

The rapid development in the transmission field has materially changed conditions, and rendered much apparatus obsolete, the early insulator being no exception.

As causes of losses have become evident, means have been found to eliminate the serious effects of same. The recognition of the increased value of reliability together with the study of operating conditions has materially changed the insulator situation, so that the material going to the scrap pile today is more suitable for line work than the best product a few years ago. The loss from porosity has been reduced to a negligible quantity by improved firing methods and a closer selection.

To prevent the serious cracking loss noticeable on old insulators, has been the most difficult problem. To prevent trouble on old lines, it may be necessary to give the insulators a temperature, as well as an electrical test.

Trouble from this source on modern insulators is prevented by careful attention to the temperature gradient, increased mechanical strength to resist internal stresses, and a lowering of the internal stresses by means of an elastic joint.

The performance of the modern insulator is very gratifying, and its performance must not be judged by insulators which are really obsolete.

A written discussion on these papers by Harris J. Ryan was read, in which he said in part that the present papers have their origin in the transmission practice, the research laboratory and the factory. They are of high value. Strangely enough, the practice paper lowers and the factory paper raises the estimate of the importance of the quality of porcelain for

high-voltage insulators. This is the result of an oscillation that has occurred in the process of each coming to the point of view of the other and going a little beyond.

James Cameron Clark mentioned that Mr. Peaslee is very optimistic about the use of fused quartz. He had endeavored to ascertain what well informed ceramists think of the possibilities of fused quartz when used for insulators and he found them rather dubious about its permanency as a material for this purpose.

E. E. F. Creighton said the records that have come to his attention of insulator failures in the East show a large percentage of defects by porosity, although he was of the opinion that cracking had somewhat predominated. Careful distinction must be made between deterioration of insulators and deterioration of porcelain. It is probable that the latter occurs only through the opening of the pores due to freezing of moisture therein. He believed that porcelain can be made which will not deteriorate at atmospheric temperature in any reasonable time, if ever.

Edward M. Hewlett gave an interesting description of the experiences with earlier forms of insulators.

Percy H. Thomas said that he was inclined to take very seriously the evidence Mr. Brundige had brought out, as his opportunities for observation are very broad, they are possibly not as good in the laboratory as those of other men, but as regards practical working conditions he had a wide range to work on.

John B. Taylor remarked that he thought it was possible to look at the right values for the specific inductive values of quartz for the different optic axes, and these should be added to the data given to justify drawing any conclusions from these theories which are advanced.

C. Francis Harding showed some slides giving views of flashover tests of insulators, showing the conditions under which they punctured dry and punctured wet.

Jacob T. Barron raised some question regarding the reliability of the data in Mr. Brundige's paper, because in the past there has been not only one type of insulators which had been exceptionally poor, but there have also been large numbers of insulators of the same type, or of one type, which have been exceptionally good, and he thought that was a feature which had to be taken into consideration in comparing data showing the past performance of insulators.

Philip Torchio contributed briefly to the discussion, after which the authors closed.

At the Thursday morning session, which was called to order at 10:40, two papers on mining subjects were presented. The first one, by R. L. Kingsland, was entitled:

Forms of Electric Power Best Suited for Various Loads Encountered in the Operation of Bituminous Coal Mines.

This paper discussed the power requirements for drilling, cutting, hauling, pumping, lighting and ventilation in coal mines. The relative advantages of synchronous converters and motor-generators were compared and the former favored. The location of generating plant and substations is also discussed, the advantages of alternating-current being especially pointed out.

Test of a Large New Electric Mine Hoist at Butte, Mont.

This paper, by R. S. Gage, described the equipment in connection with a recent Ilgner-Ward Leonard hoist installation for the Elm Orlu Mining Company, Butte, Mont. This installation is one of the two largest of this type in operation in this country. Complete data on two sets of tests were given; the first was conducted to analyze a typical day's run and the second to determine the efficiency while hoisting under known conditions.

In opening the discussion on these papers, K. A. Pauly cautioned beginners from giving undue importance to the cost of feeder copper. It must be borne in mind that by the use of alternating-current apparatus wherever possible we eliminate the standby losses of the converting apparatus and especially where the load is an intermittent one these losses may become a very considerable percentage of the total power consumed in performing the particular operation. On the other hand, money invested in feeder copper affects the operating costs only by the fixed charges, and salvage on copper is so very high that the use of plenty of feeder copper usually results in lowering the operating costs. With reference to the hoist tests, he stated that it is often said this or that thing is all right in theory, but it does not work out in practice. The trouble in such cases is usually not with the theory or the practice, but due largely or wholly to failure to include in an analysis of a problem all the factors affecting it. The calculation of the useful work in hoisting, as is frequently the case in problems of this kind, is comparatively simple and susceptible of great accuracy. The demonstration of the losses is not so simple, but even these with the electrically driven hoist do not present any serious difficulties, if care commensurate with the problem is taken. The present paper is a most interesting example of that point, and would convince the most skeptical engineer of the possible accuracy of predetermined power consumption for mine hoists.

C. M. Means, in written discussion, called attention to the fact that Mr. Kingsland's paper touches a field that has not received the intensive study that has been accorded many other lines of electrical engineering of relatively less importance.

A. B. Kiser communicated a discussion in which he said that in the near future most of the power that will be available in our coal fields will be in the form of alternating current, because coal companies during the past five years have awakened to the advisability of purchasing their power or of building comparatively large central stations of their own. In either case the power will be generated as alternating current. The frequency available will, of course, be determined by the power companies and will probably be 60 cycles. Recent developments have made it possible to operate 60-cycle apparatus as satisfactorily as 25-cycle apparatus.

Graham Bright, also in a communicated discussion, pointed out that considerable impetus has been given to the use of central-station power in mines due to the fact that the value of fuel has so greatly increased in price during the last year or so, while the price of central-station power has practically remained constant. A few years ago it was a very difficult matter to persuade a coal operator that he could purchase power as cheaply as he could produce it. The great success of a large number of mining companies that have changed over to central-station power makes it no longer a question of doubt and there are few operators today who will contend that they can produce power cheaper than they can purchase it from a central station.

L. C. Ilsley stated that pumps and hoists operated

by alternating-current motors are already in universal use and in most cases are preferred to similar equipment operated by direct-current motors. The alternating current simplifies the lighting problem, since it provides a more flexible voltage. Alternating-current coal-cutting equipments have been on the market for some time and are in apparently successful use. On account of the excessive amount of dust which attends the mining of coal,. alternating-current motors are much to be preferred to direct-current motors for the various miscellaneous uses around a mine, both inside and out.

There was some further discussion by F. J. Duffy, after which the authors closed.

At the last session H. S. C. Putnam presented a paper entitled:

Economical Combination of Water Power and Steam Plants, and a Convenient Method of Solution.

This paper attempted a determination of the respective economic limits in steam and water-power plant developments. Formulas are derived for determining total annual costs of each type of plant and the most economical combination. The general conclusions reached are as follows:

Where a market for the power is available or can be created, practically all water powers should be developed beyond the minimum power available, and hence all water-power plants require steam plants in connection with them.

Water-power plants are most valuable when developed in connection with steam plants, and the development should be carried to the point where the best results can be obtained in combination with such steam plants.

The point of economical development of the water power is increased in capacity as the operating costs of the steam plant are increased, such as are due to the increased cost of fuel and labor.

The point of economical water-power development is decreased as the value of money increases. This is true in general, although there are exceptions in the case of water powers with high heads.

The general tendency of coal and labor and other items entering into the operating cost of a steam plant is upward, and as the world increases in wealth the tendency in the value of money will be downward. These factors should be kept in mind in planning the development of a water power and adequate provision should be made for the possible extension of its capacity.

The increase in the efficiency of steam turbines and the construction of steam plants at the coal mines both operate to make it difficult to profitably develop water powers, especially those with low head, where the first cost is relatively high. The development of all possible water powers should be encouraged, both for the conservation of the fuel supply and the economical advantage resulting from the use of power in our industries. It is, therefore, important that all rights essential to the development of water power and transmission projects should be given power companies, to the end that the cost of development should be reduced and many serious difficulties now encountered removed. Any policy under which additional burdens are imposed upon water-power developments, whether by the government or other authority, is against the true interests of the public and contrary to the best utilization and preservation of our natural resources. On the contrary, if a plan could be devised for securing government funds at low interest, the development of water powers would be greatly facilitated and the financial values created would react to the advantage of the government.

Cary T. Hutchinson opened the discussion by expressing the opinion that the water-power plant had the advantage at the low-load period of operation, but not at the high-load period. The capital charges for the steam plant are increased more rapidly than on the water-power plant, and in addition there is less economy in the case of the steam plant operating at low power-factors. The water-power plant is not a high load-factor proposition, but a low load-factor proposition; in other words, the water-power plant should take the low load-factor and not the base load.

H. R. Summerhayes called attention to the fact that Dr. Steinmetz brought out the idea that the induction generator on account of its simplicity could be used to a greater extent in the development of water power than as an auxiliary apparatus. That has actually been done in one or two cases, and there is one case in the state of Washington in which a 1700-kilowatt generator has been installed directly connected to a water wheel and is some two miles from an already existing plant on the same river and uses the same water.

V. M. Montsinger then read his paper, entitled:

Cooling of Oil-Immersed Transformer Windings After Shutdown.

The A. I. E. E. rules require the temperature rise of transformer windings to be observed by the resistance method. Since this measurement requires considerable time, there is always a drop in temperature between the instant of shutdown and the time of observing the resistance measurements. The author discusses the three methods of determining the temperature at shutdown as follows: Take a cooling curve and extrapolate back to the instant of shutdown; use an arbitrary correction; calculate the rate of cooling. The advantages and shortcomings of each method are given.

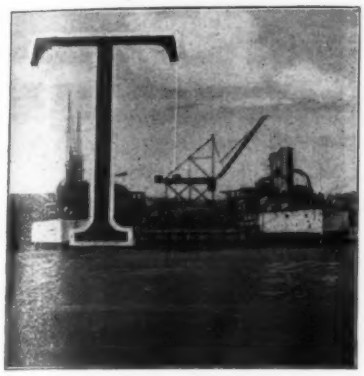
Discussing this subject, F. A. Brand said the fact that transformer windings in oil do cool very appreciably is a very important fact both for the manufacturer and the purchaser. The author had fortunately developed a method which is very simple, for the manufacturer, at least, to apply. It is a fact in modern transformers, particularly those of the artificially cooled type, the windings usually operate at a fairly high current density, and therefore, if it takes one or two or three minutes to get an accurate reading of the resistance after shutdown then the amount of cooling which the transformer will go through in this time is quite appreciable, and it may be five degrees or ten degrees.

L. F. Blume said that the only objection to using the method under consideration is the fact that its use requires a knowledge of the watts per pound of copper lost in the windings. From the point of view of the manufacturer this offers no difficulty, but to the purchaser who wishes to determine by means of test the operating characteristics of the transformer he is buying, it is objectionable, because this value cannot be obtained by test. In the latter instance, of course, the only resource would be by the extrapolation method.

There was further discussion by W. C. Smith and L. T. Robinson, and closure by the author, after which the meeting adjourned.

Editorial Comment

SPEEDING UP SHIPBUILDING—A CENTRAL-STATION OPPORTUNITY



THERE is no single factor affecting the welfare of the Nation in its present crisis that is of such immediate concern or that will have such a vital effect on our future destinies as *shipbuilding*. Men and women for active service must and will be secured; likewise supplies and equipment of every kind are being conserved and production stimulated to the highest degree. But, allied as we are with countries across the sea, our most strenuous preparedness activities will be of little avail without the necessary tonnage to transport our men and supplies to Europe.

It is natural, therefore, that the slogan of the times should be "*Speed up Shipbuilding*," and it ought to be particularly gratifying to those engaged in the electrical industry to know that in the accomplishment of this end there is no element of more importance than electricity.

It has been demonstrated in shipbuilding plants, as well as in countless other industries, that electric motor drive permits of operating machines at their maximum productive capacity, thus attaining the highest shop time-factor, an advantage of the greatest importance under present conditions. Furthermore, only by the aid of electric lighting is it possible to continue work in ship ways and in other locations about the yard at night. Maximum production in shops and offices is also dependent upon adequate lighting, such as can *only* be satisfactorily obtained by the use of the modern electrical equipments now available.

The participation of the electrical industry in the unparalleled activity in shipbuilding is, therefore, a broad, patriotic duty. Actuated by this thought, we have devoted a large part of the current issue to the subject, with the idea of showing in just what way electricity can be of the greatest service to the nation. Practically every branch of the electrical industry is concerned in this movement. Central-station companies are at present supplying the demands of a majority of the existing shipbuilding plants and are preparing to furnish service to the additions and extensions which are being made. New shipyards now being located within the territory served by central-station companies form a great potential load. Incidentally, as the government has adopted the rule of awarding contracts at cost plus 10 per cent, shipbuilders should be particularly interested in the economy of purchased power. Manufacturers, jobbers and electrical contractors are also directly affected; the former in the manufacture and distribution of the vast quantities of electrical equipment needed, and the latter in the wiring of shipbuilding plants and aboard ships.

An interesting sidelight on the enormous proportions of shipbuilding may be gleaned from the remarks made by Mr. Charles M. Schwab of the Bethlehem Steel Company in an address at Detroit. This company is putting $20,000,000 into electrically operated steel and shipbuilding plants entirely for the use of the United States government and its allies. "We feel," he said, "that the plants of the Bethlehem Steel Corporation, for ordnance making, for steel manufacture and for shipbuilding, constitute a national asset in a supreme crisis like this. It is our ambition to make that asset of the greatest possible effectiveness in assuring for our country and for our allies an overwhelming victory in this the greatest of all wars."

Mr. Schwab said further, that while up to now this country has been largely concerned with domestic problems, both in politics and business, the end of the war will find the United States engaged in world politics, in international trade and in world affairs on the largest possible scale.

Mr. Schwab spoke only for the Bethlehem Steel Company. Other companies, as indicated by our careful compilation of statistics presented elsewhere, are also spending tremendous amounts for new equipment. In fact, the industries of the whole nation are busy fabricating the necessary parts which go to make up the carriers and protectors of the commerce of a nation at war. Into all this activity, touching in a vital way every element of production, electric energy and electrical equipment enter as indispensable factors. From the standpoint of the electrical industry, shipbuilding is today truly the greatest opportunity.

The Engineering Council

THE national engineering societies have at last taken a step which will permit of united action by the engineers of the country in matters of a technical nature. Heretofore, there has been no medium for the expression of general engineering sentiment or opinion in matters of national importance, or for the handling of technical matters which do not come exclusively within the province of a single society. The United Engineering Society was formed mainly for the purpose of carrying out the scheme for a building in New York City to be devoted to the uses of the engineering societies and to provide a home for them, and this movement resulted in the Engineering Societies Building at 29-33 West Thirty-ninth Street. This is already the house of the founder societies and of many other engineering associations which have availed themselves of the opportunity of renting rooms for headquarters amid congenial surroundings and in a congenial atmosphere. The building is now being enlarged to provide rooms for the American Society of Civil Engineers, which recently decided to join with the other national societies as a constituent part of the United Engineering Society.

The need of an organization which could handle matters of importance to the welfare of the engineering profession has been felt for some time, and a committee of the four national engineering societies decided that this could best be accomplished through the medium of the United Engineering Society. The by-laws of the latter have consequently been changed to permit the creation of an Engineering Council, to be formed of five representatives of each of the four constituent societies and four representatives chosen by the Board of Trustees of the United Engineering Society. The Trustees may elect other engineering societies to membership in the Council. The Council is intended to speak authoritatively for the member societies on all public questions of common interest, but its action is subject to the veto of any member society.

One of the first things with which the new Engineering Council should concern itself is the subject of general engineering standards. Individual societies have adopted codes covering their own fields, prominent among which are the standardization rules of the American Institute of Electrical Engineers. At the present time, however, we have no body which has concerned itself or has been in a position to concern itself with the general subject in such a way as the Engineering Standards Committee has done in Great Britain. The subcommittees of the latter have been representative of the various industries, professional societies and branches of the Government interested in the particular fields covered, and thus have been able to secure the co-operation necessary to attain results which shall be valuable, satisfactory and applicable in the industries involved. Much progress in standardization in engineering lines has been made as a result of this organization and co-operation.

Co-operation is necessary to any valuable achievements in this direction and the Engineering Council offers the opportunity for such co-operation in this country. It is to be hoped that action to initiate such co-operative effort will soon be taken after the Council has been organized and gets down to work. This, however, is but one instance of what the new Council may accomplish in fields which are common to the different branches of the engineering profession, and engineers will look forward expectantly to the work of the Council.

While the proposal for such an organization has come at various times from various sources, the present movement took definite shape only during the past winter, and electrical engineers will be pleased to know that the American Institute of Electrical Engineers has taken an active part in the negotiations which have led to some valuable accomplishment in this important direction.

Publishers' Announcement

SINCE November 1, 1908, when the WESTERN ELECTRICIAN was merged with the ELECTRICAL REVIEW, we have retained the combined title of ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, for in spite of its awkwardness it was considered desirable to retain the identity of both names, as at that time each journal had a somewhat separate field. The WESTERN ELECTRICIAN being published in Chicago paid most attention to the West, while the ELECTRICAL REVIEW, with headquarters in New York, had its widest influence in the East. Since the consolidation the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN has made wonderful strides and today stands second to none in prestige or influence in every section of the country.

We think it fitting therefore to remove any hint of sectionalism from the title and also in the interest of brevity we shall be known henceforth as the ELECTRICAL REVIEW.

With this issue we also inaugurate a number of changes in our previous style which we feel is another step in advance and in accordance with our policy of continually improving service to the reader.

It is our ambition to make this journal the one interesting and comprehensive weekly publication of the ever-expanding electrical industry, and our increased staff and augmented resources permit a nearer realization of the full scope of the REVIEW than ever in the past.

The ELECTRICAL REVIEW, now in its thirty-sixth year of continuous publication, with increased faith in the science and industry of which it has ever been the loyal and independent exponent, looks confidentially to the future development of the greatest and most useful servant of mankind—Electricity.

HAPPENINGS IN THE INDUSTRY

Secretary Lane Says There is Coal Enough for All—Organization Meeting of Engineering Council—Government May Build Power Plants—Indiana Companies Seek Rate Increase

SECRETARY LANE SAYS THERE IS COAL ENOUGH FOR ALL.

Official Figures for Six Months Reassuring to Coal Users —Economy Must be Practised However to Insure Sufficiency.

Not only food but fuel is a vital need of this country and of our allies—coal to run the ships and railroads, to feed the iron furnaces and furnish steam for all the manufacturing plants, coal in greater quantities than have ever before been mined in the United States or in any part of the world—and this need is being met in truly American fashion by the operators and owners of the mines and by the diggers of coal. With these words, Secretary Franklin K. Lane began his statement regarding the coal situation as reported to him by the statisticians of the Department of the Interior.

The production of coal in the United States last year, he continued, was the greatest in the history of the country. A new record, however, was set for the first six months of this year, fully 270,000,000 tons of bituminous coal being produced since January 1, thus exceeding the output of the first six months of last year by about 20,000,000 tons. Even better news is that the limit has not yet been reached, for as the railroads are able to work out to better advantage the problem of car supply and give to the mines greater facilities for transporting their product to market, the supply of coal that reaches the consumer will be in steadily increasing quantities. In the early months of 1917, because of the congestion of the railroads and the difficulties of transportation, the production of bituminous coal fell behind the high mark set in January and February, a year ago. As a result of the patriotic and earnest endeavor of the railroad officials and the coal operators and representatives of mine workers who have volunteered their services to the Federal Government in this emergency, production has been speeded up within the last few months and the output of soft coal which in May exceeded all previous records, was surpassed in June.

Despite the extra demand in this country and the urgent needs of our allies, no one with the facts before him can doubt that the coal industry, under the careful guidance of those now directing its welfare, will be able to supply all needs.

The difficulty of distribution now so great will be intensified, however, in the coming winter months. Just as consumers of foodstuffs are being urged to eliminate all waste and to practice sensible economy, so the consumers of coal must do their share in working out the coal problem by unloading every coal car as fast as it is received, and in improving their plants so as to utilize to the fullest the heat value of the coal that reaches their bins. In stopping the coal panic and in expediting a condition of fuel sufficiency, every consumer can do his bit.

ORGANIZATION MEETING OF ENGINEERING COUNCIL.

Representatives of the Leading Engineering Organizations Meet to Elect Officers and Offer Assistance to Government.

On June 27 was held the first meeting of the Engineering Council. This body is a department of the United Engineering Society and has recently come into being as a medium of co-operation between the four national engineering societies. The function of the Council may perhaps best be described by the following extract from the by-laws of the United Engineering Society: "The Council may speak authoritatively for all member societies on all public questions of a common interest or concern to engineers."

The Council is composed of 24 members, five being appointed by each of the four founder societies and four by the United Engineering Society. Its present membership follows:

American Society of Civil Engineers.—J. F. Stevens, George F. Swain, F. H. Newell, Alex. C. Humphreys, F. D. Galloway.

American Institute of Mining Engineers.—P. N. Moore, S. J. Jennings, B. B. Lawrence, J. Parke Channing, Edwin Ludlow.

American Society of Mechanical Engineers.—I. N. Hollis, C. Whiting Baker, John H. Barr, A. M. Greene, Jr., D. S. Jacobus.

American Institute of Electrical Engineers.—H. W. Buck, E. W. Rice, N. A. Carle, P. Junkersfeld, C. E. Skinner.

United Engineering Society.—Clemens Herschel, B. B. Thayer, I. E. Moultrop, Calvert Townley.

At the organization meeting held in the rooms of the American Society of Mechanical Engineers at 2:30 o'clock p. m., on June 27 the following officers were elected:

President, I. N. Hollis.

Vice-presidents, H. W. Buck, George F. Swain.

Secretary, Calvert Townley.

Executive Committee, the four officers named with J. Parke Channing and D. S. Jacobus.

The Council discussed at length ways and means by which the founder societies through the Council may be of use to the nation. The unanimous desire to help the government in the prosecution of this war resulted in a resolution instructing the Executive Committee to co-operate with the government in procuring the services of engineers, also the appointment of a committee of three consisting of H. W. Buck, A. M. Greene, Jr., and Edmund B. Kirby, to consider the best means of utilizing the inventive ability of members of the founder societies.

The secretary was instructed to inform all government bureaus that might be interested in the organization of the Engineering Council and its desire to be of assistance.

GOVERNMENT MAY BUILD POWER PLANTS.

Need for Coal Conservation Is Causing Washington to Consider Development of Water-Power Sites.

The exigencies of the coal and railroad situation are causing the Government to consider the advisability of entering upon huge water power construction as a method of relief both to the coal situation and to the railroad difficulties. While the proposition has gone but little farther than informal discussion, it follows closely the recent appeal of Secretary Lane to electrical men to develop all the water-power sites possible and to increase hydroelectric station capacity wherever it can be done.

That such a proposition should be considered as a government project is largely due to the enormous capital requirements needed to put the hydroelectric properties into operation in time to benefit the country. Not only is the project too big to leave for private initiative in mere magnitude of capital, but the difficulties of raising such funds at equitable interest rates could hardly be undertaken by private capitalists at this time. Furthermore the costs of construction and materials are a handicap which only the government can overcome by requisitioning materials at prices considerably below market values.

The situation involves the dangers of political management and departmental bungling, but there is hope that if the Government does take action it will be to create a special commission putting the work in charge of the highest grade utility engineers and operators and in every respect putting the work on as efficient a basis as can be done with the least political interference. No plans are as yet formulated, but it is generally expected that if undertaken a special bond issue would be made, and the hydroelectric plants operated as separate units.

INDIANA COMPANIES SEEK RATE INCREASE.

All Central Stations File Petitons With Commission Through State Utility Association.

The Indiana Electric Light Association has filed a petition with the Public Service Commission asking increased rates for electric service. Authorization of a surcharge not to exceed 30 per cent of the present rates is desired, and the petition says the surcharge should be flexible, so that when the cost of the operation of an electric plant goes up the rates could be increased, and when the cost goes down the rates could be reduced.

It is assumed in the petition that present rates were based on a reasonable cost figure at the time they were established, and that any increase granted should be based on the increased cost of coal, labor and materials since that time. It is set out that the per cent of increase of prevailing prices in operating expenses at this time over normal cost prices are as follows:

Coal, 194 per cent; labor, 32.67 per cent; copper, 144.86 per cent; miscellaneous supplies, 65.91 per cent; taxes, 48.41 per cent; equipment, 51.14 per cent, and general operating expenses 45.50 per cent.

The petition asks that a horizontal surcharge be granted that would apply to all of the companies that are members of the association. It is pointed out that the government is establishing many manufacturing plants and industries in Indiana, all of which must be equipped with electricity, and that other plants are being greatly enlarged. All of this additional equipment and extension of electric service costs money, and when the companies are making little or no profit, the petition says, it is impossible for them to get money through the sale of their securities. Investors will not buy unprofitable securities, it is said.

The officials of the association were not decided as to whether their petition should come to the Commission as that of a group of practically all the electric companies of the state, or whether it should be filed in the name of the Indiana Electric Light Association.

NEW YORK STREET RAILWAYS ASK FARE INCREASE.

All Important Companies Except in New York City and Buffalo Affected by Petition to Commission.

Petitions have been filed with the Public Service Commission for the Second District of New York, asking for an increase in fares on all the important street railways in New York state outside of New York City, except in Buffalo. The petitions were filed by Joseph K. Choate, chairman of the special committee on ways and means to obtain additional revenue.

Mr. Choate, in commenting on this action, made the following statement:

"Of course the Commission will want to consider the case of each particular company, and the individual companies are preparing the special facts relating to themselves, for detailed presentation to the Commission.

"But there are certain unusual facts underlying the whole industry which apply to one company quite as much as to another. It is the view of the managements of the electric railways of New York State that the conditions which confront them are so abnormal that the situation can best be presented to the Commission as a general proposition of universal application.

"The most important factor in the whole situation, as it concerns the public, is the practical impossibility under present conditions of securing new capital for investment in street railroad properties.

"Such has been the increase in costs of operation in recent years that not only have the companies been forced to skimp in maintaining their standard of operation, but the return to capital has been in a steadily diminishing ratio.

"If the companies are to be permitted to maintain the standard of their service in accordance with the continual improvements in the art; if they are to be able to extend their service in accordance with the needs of the growing communities they serve, it will, as we see it, be absolutely necessary to deal with the situation as a whole, in addition to giving attention to the requirements of individual companies.

"It will be in this spirit that we shall present the matter to the Commission on behalf of all street railroad companies of New York State. The fundamental fact in the whole situation, as we see it, is that we are not increasing the price of our service. The fact is that the purchasing power in labor, materials, etc., of the five cents paid for the service, is so seriously decreased that we are compelled in the interests of our service to attempt an equalization. Even a six-cent fare under present conditions will not be as valuable as a five-cent fare was five years ago."

New Electrical Appliances

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

Temperature Variations Cause New "Thermostatic Metal" to Control or Regulate Devices.

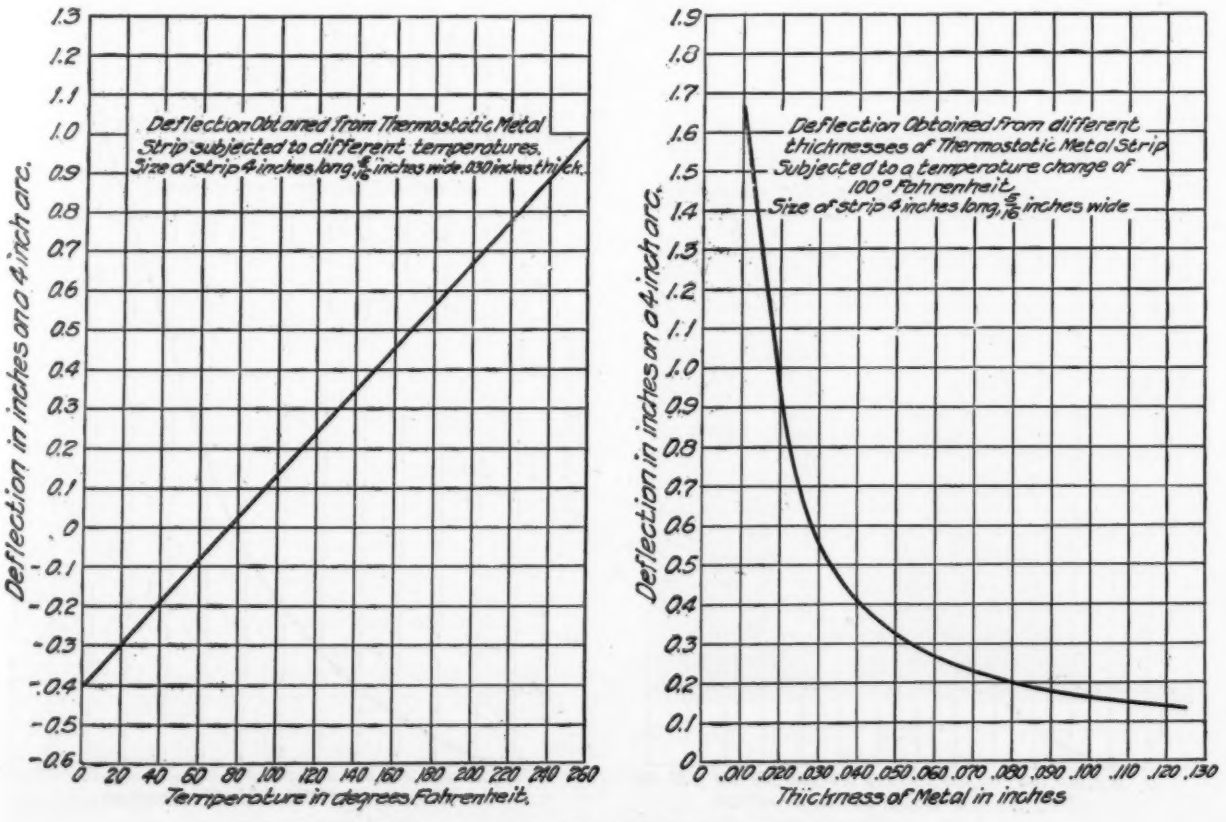
The General Electric Company, Schenectady, N. Y., has perfected a new product called "G-E Thermostatic Metal," which takes a curve or regains its original straightness in accordance with well defined laws as the temperature rises or falls. As a result of this responsiveness to temperature change and the mechanical force developed, this metal is used to actuate various mechanisms which tend to neutralize either the temperature change or its effect upon devices.

G-E Thermostatic Metal consists of two strong non-corrosive metals possessing a wide difference in coefficients of expansion, the widest difference possible for any known stable combination of metals. These two metals are firmly attached to each other throughout their entire length, so that there is absolutely no slip of the one metal upon the other. Thermostatic metal can be cut, stamped or pressed into practically any desired shape, and when annealed will have all its original inherent qualities; moreover, it will not deteriorate nor take permanent set under applications of heat or force within definite practical limits. The metal is manufactured in various standard thicknesses ranging from 0.25 to 0.015 inch, up to a maximum width of 4 inches and maximum length of 36 inches.

As an indicator this metal is remarkable in that it can be used for temperatures as high as 500 degrees Fahrenheit. The deflection per degree of temperature change, besides being quite considerable, is a constant for any definite piece of the metal and since a definite and considerable opposing force is necessary to cause the metal to take permanent set, the metal can be depended upon when used in devices where extreme accuracy is required.

If the curving of this thermostatic metal on heating or cooling is opposed, the metal will produce a mechanical force which is limited only by the force required to produce permanent set. For example, a piece of thermostatic metal one-tenth of an inch thick, 5-16 inch wide and 4 inches long will exert a force of 24 ounces on being restrained from bending when subjected to a temperature change of 100 degrees Fahrenheit. The force exerted by this metal varies as the square of the thickness, directly as the width and as the square of the temperature.

Various curves have been drawn to show the de-



Curves Showing Deflection Obtained From Thermostatic Metal.

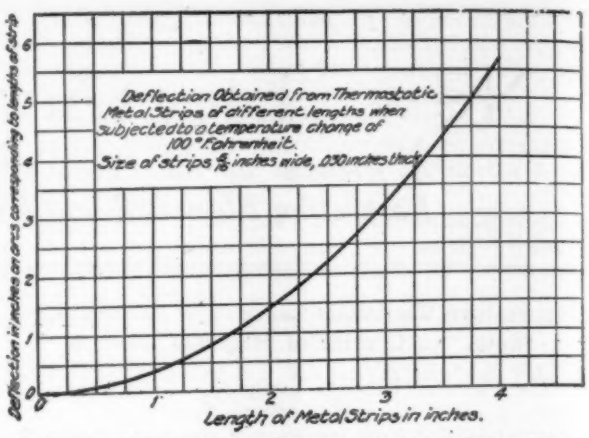
flections resulting as one of the two dimensions, length or thickness, varies with a definite change in temperature, the width of the piece having no influence on the deflections resulting from temperature change. From these curves it is found that the deflection for any given temperature change varies directly as the square of the length of the piece of thermostatic metal and inversely as the thickness of the piece. As previously pointed out, the deflection of any piece of metal varies directly as the temperature change.

G-E thermostatic metal is used in the products of many different industries, owing to the fact that it can be successfully worked into different shapes and forms. In some of its applications it is used to actuate mechanisms directly by means of the force developed within itself when its tendency toward assuming a curved shape is restrained. In other applications it is used to close and open the contacts of electrical circuits by means of which various devices are operated.

It has possibilities in carburetor manufacture, in automatically controlling the richness of the mixture as the temperature changes; in scales, balances and other scientific instruments in compensating for errors due to temperature changes; in furnaces, incubators and refrigerators for controlling the temperature. In these latter applications the non-corrosive characteristics of the metal are to its advantage.

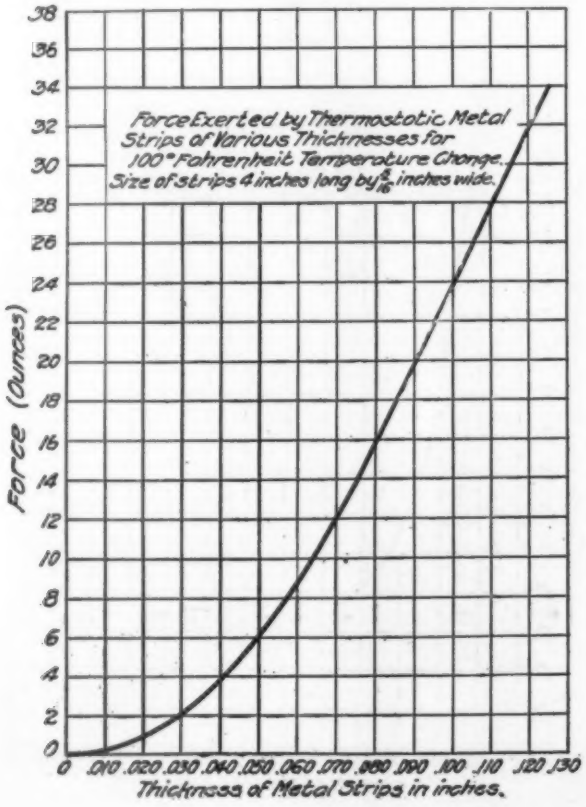
The reliability of this metal has merited its use in thermometers and has gained consideration for it as a compensating device in watch balances, and it is but a step forward to see it used in the proverbially accurate ship's chronometer.

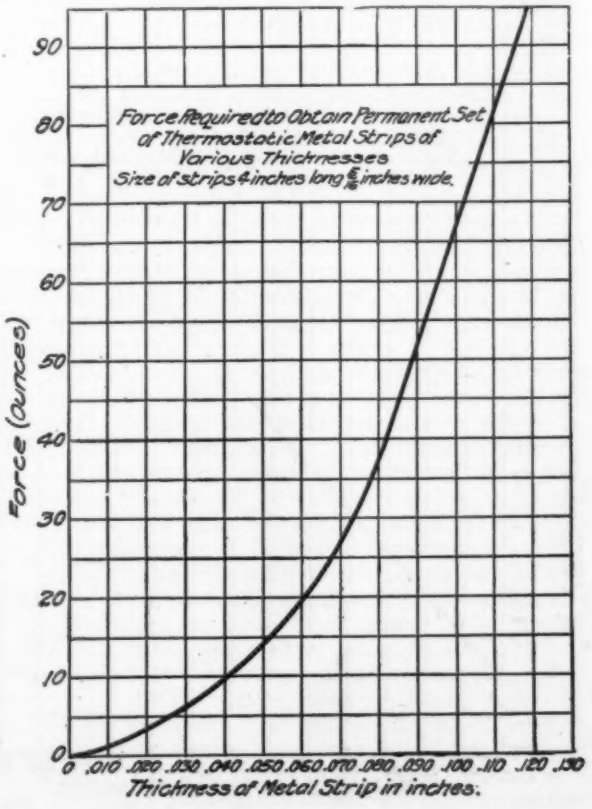
Thermostatic metal is a product of the Fort Wayne, Ind., works of the General Electric Company where the desirability of a metal with its characteristics arose from necessities in the construction of certain types of electric meters. This metal met the requirements so fully that manufacturers who had thermostatic and heat-compensation problems have adopted it readily for their purposes.


Deflection Obtained from Thermostatic Metal Strips of different lengths when subjected to a temperature change of 100° Fahrenheit.
Size of strips 5/16 inches wide, .030 inches thick
Deflection in inches or ers corresponding to lengths of strip
Length of Metal Strips in inches.

Deflection Obtained From Thermostatic Metal Strips When Subjected to Temperature Changes.

Electric Rates Based on Price of Coal, New Jersey.—Pending further hearing, the Board of Public Utility Commissioners has suspended the proposed new rates for electric energy submitted for approval by the Bridgeton Electric Company, operating at Bridgeton and vicinity. The company proposes to base its rates for consumers on the price of coal, adding one per cent to the bill for each 10 cents per ton in excess of the average prevailing rate of coal, $3.50, and deducting one per cent for each 10 cents per ton below this figure the coal might cost. The Electric Company of New Jersey, operating in Gloucester County, has submitted a similar plan to the board for approval.

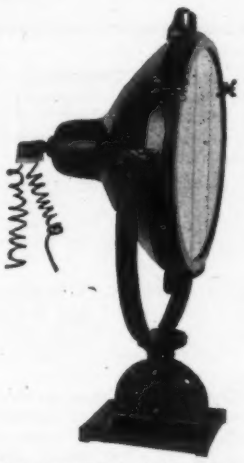

Force Exerted by Thermostatic Metal Strips of Various Thicknesses for 100° Fahrenheit Temperature Change.
Size of strips 4 inches long by 5/16 inches wide.
Force (Ounces)
Thickness of Metal Strips in inches.


Force Required to Obtain Permanent Set of Thermostatic Metal Strips of Various Thicknesses
Size of strips 4 inches long 5/16 inches wide.
Force (Ounces)
Thickness of Metal Strip in inches.

Curves Showing Force Exerted by Thermostatic Metal.

Cutter "Universal" Flood-Light Projector.

The varied usages to which modern flood-lighting equipment may be applied constitute a very substantial reason for the popularity such equipment has reached. The recent adaptation of projectors for protecting industrial plants at night furnishes a good illustration of how universal the service afforded by flood-lighting units is becoming. The wide range of this utility in projectors has been appreciated in the design of a new flood-lighting unit by the George Cutter Company, South Bend, Ind., which has been named the "Universal" because of its adaptability to the many conditions of service that may be imposed on such a unit.



Cutter "Universal" Flood-Lighting Projector.

The new projector has several distinctive features. It has a one-piece body, made of either cast iron or aluminum, which forms the housing for the reflector. This body serves as an adequate protection against denting and abuse to the reflector, which must retain a true parabolic shape for correct projector lighting. In designing the metal body, provision was made for changing of reflectors, a feature which will be recognized as very convenient when it is desired to change the distribution of light. Thus, a wide-angle reflector may be substituted for a narrow-beam reflector by merely opening the glass door, removing the lamp and changing reflectors.

By referring to the accompanying illustration it will be seen that the unit can be adjusted to project the light rays in any direction, it being possible to rotate the body of the lamp through 360 degrees in the vertical and horizontal planes. Besides permitting of further directional adjustment, the mounting plate lends itself readily for mounting the unit on a pipe standard, platform or pole, or it may be suspended from a ceiling or wall. No matter what the mounting position, the body may be adjusted to project the light rays in any direction desired. The unit also will be furnished with a four-foot pipe stand, which provides for mounting in inaccessible places, such as for projecting over the cornices of buildings, etc.

Although designed particularly for the new 200 and 400-watt projector lamps, other lamps having concentrated filaments may be used very successfully in the new unit. The socket is designed for adjustment to change the focus, the spread of the beam being altered to suit any particular condition. When the adjustment is made, the socket is locked in place by means of a countersunk set screw.

There are no ventilated openings in the body itself. The lamp is cooled by the circulation of air between the reflector and body and within the paraboloid itself, the air being cooled by radiation from the body. The manufacturer states that tests have proved this method to be entirely satisfactory. The fact that the body has no opening in it and that the door is secured air-tight by means of a gasket renders it impossible for fumes, smoke and bad atmospheric conditions to affect the silver-plated steel reflector. The latter can be damaged only by the action of the lamp itself and in such a case could be replaced with a new one at a small expense.

The hinged door is fitted with sectional wire glass. It is held in place with wing nuts and may be locked with a padlock to prevent theft of the lamp. The hinge for the door may be at the top when the projector is installed, but when carried by the handle the hinge is on the lower side. Each projector is equipped with a condulet terminal fitting and connecting wire. All parts are black enameled.

The simplicity and practicability of design of this flood-lighting unit recommends it as a popular addition to the line of Cutter industrial lighting equipment.

Simple Universal-Type Sewing-Machine Motor.

The Pittsburgh Electric Specialties Company, Pittsburgh, Pa., has placed on the market a universal-type sewing-machine motor of very simple design. It fits any make or style of machine and is attached without brackets, pulleys, screws or clamps.

All that is necessary is to place it in position so that its pulley engages the wheel of the machine and it is ready for work. It is so balanced that it remains in position without being fastened.

The speed is regulated and the motor started and stopped by a simple foot control located on the floor.

The motor is light and convenient to handle and gives the machine an absolutely steady motion. The weight is five pounds. The price of the motor complete with foot control is well within the reach of practically all housewives that do considerable sewing.

Simple and Inexpensive Sewing Machine Motor for Use on Direct or Alternating-Current Circuits.

Activities in the Trade

The Standard Underground Cable Company, Perth Amboy, N. J. is building an extension to its plant.

The De Laval Steam Turbine Company, Trenton, N. J., has awarded contracts for the erection of several new additions to its plant.

The Electric Storage Battery Company, Nineteenth Street and Allegheny Avenue, Philadelphia, Pa., has filed plans for the erection of an addition to its plant.

W. S. Barstow & Company, Inc., 50 Pine Street, New York City, have published a book of 71 pages on Public Service Properties having annual gross earnings in excess of $7,000,000. The affairs of fifty-eight to sixty companies are dealt with, by way of financial statements and an outline of the localities they serve, and the kind of service rendered, whether electric, gas or other utilities. A map accompanies the data on each company, indicating the extent of its transmission or distributing lines. The book is valuable for reference.

G. J. Gebhardt Company, Fisher building, Chicago, has installed an Electric Machinery Company synchronous motor in the plant of the Jefferson Ice Company, at Grand Avenue and Bickerdike Street, Chicago, to operate a De La Vergne ammonia compressor, being direct-connected thereto. The speed is 200 revolutions per minute and the compressor is a 50-ton machine. This is a case of a low-speed motor operating a high-speed compressor; but, it is asserted, ammonia compressor manufacturers are now building machines to be driven at about 200 r. p. m., and adapted to synchonous motors. The severe starting conditions, it is claimed, are eliminated by an effective by-pass construction, enabling the motor to start up from standstill without difficulty.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued motor application circular No. 7193. It is entitled "Westinghouse Electrical Equipment for Ventilating Service," and describes the requirements for ventilation in various types of buildings in which it is possible to secure effectively and economcially "pure air by wire." A large number of views are shown of buildings equipped with Westinghouse motors for their ventilating apparatus. The characteristics of different types of motors for this service are described and illustrated and data given for finding the power required to drive fans and blowers.

National Carbon Company, Inc., Cleveland, O., has purchased the works and business of the American Carbon and Battery Company, of East St. Louis, Ill., and the latter is now being operated as American Carbon and Battery Works of National Carbon Company, Inc. The retirement of Henry Wrape, president of the St. Louis concern, is announced; otherwise, the management, organization and policy of American Carbon and Battery Works remain unchanged. Their specialties are American dry cells, flashlights, flashlight batteries, and carbon and graphite motor and generator brushes.

V. V. Fittings Company, Philadelphia, with branches in Chicago and New York, has issued a folder on its "V. V." safety switches, wherein are illustrated four types, each having a high grade slate base, air-break knife switch. The "C. S. F." type, in a sheet-steel box, operates with a push and pull device, giving positive make and break of switch contacts. Switch can be locked in open position; the box is baked black enamel finish and can be padlocked. The "S. F." type, for high grade installations, is contained in a weather-proof cast-iron box, and is provided with a high grade slate base fused knife switch; and to guard against accidental operation, the switch can be automatically locked "in" or "out." The spring-levered handle assures a positive "on" or "off" position of the switch; the box cannot be opened while the switch is "on." This type is only for 250-volt switches. Type "W. S. F." quite similar in arrangement to "S. F." type, is made for 250 and 500-volt spacings. Type "D. F." is designed for the highest installations, and is capable of "quick make" as well as "quick break." Positive action is secured in each case. Fuse compartment is automatically locked when switch is "in," and no live metal parts are exposed while switch is "out." It is made for 250, 500 and 600-volt spacings.

Beardslee Chandelier Company, 216 S. Jefferson Street, Chicago, has issued an illustrated folder, descriptive of the Beardslee "Shadowless Unit," adapted especially to Mazda lamps. This unit is a development of semi-indirect lighting, eliminating shadows.

The General Electric Company, Harrison, N. J., is taking bids for the erection of a two-story, brick and reinforced-concrete addition to its local lamp works, about 130 by 250 feet. An extension, 46 by 90 feet, will also be erected on Cross Street.

The Pittsburgh Electric Manufacturing Company, Pittsburgh, Pa., has filed plans for the erection of a new one-story sales and display building for electrical supplies, 210 by 220 feet, at Penn and Lexington Avenues, to cost about $50,000.

The Electro Dynamic Company, Avenue A, Bayonne, N. J., manufacturer of motors and dynamos, will build two additions to its plant. Contract for erection has been awarded to the John W. Ferguson Company, Paterson, N. J.

Sprague Electric Works, 527-531 West 34th Street, New York, presents Bulletin No. 48923, a finely illustrated, 32-page pamphlet of convenient form for filing. This issue is devoted wholly to electric hoists of one ton to six tons capacity. Descriptions and illustrations are of interest to those who operate this kind of equipment. They show the adaptability of these hoists mounted on motor-driven bridges in foundries, or on hand-geared bridges similarly situated. Other installations given consist of a direct current monorail hoist with enclosed cage for outdoor service, and chain hoist equipped with motor-driven trolleys. Much data are given relative to this line of equipment.

Largest Hotel in the World to Have Westinghouse Equipment.—Announcement has just been made by the Westinghouse Electric & Manufacturing Company that it has been awarded the contract for furnishing the electrical equipment for the new Pennsylvania Hotel now being erected at Seventh Avenue and 33d Street, New York City. This, when completed, will be the largest hotel in the world, containing 2200 rooms, each with a bath. The hotel is being erected by the Pennsylvania Railroad and will be operated under the well known Statler management. The electrical equipment consists of 44 ventilating motors with a total capacity of over 800 horsepower; 7 pump motors with a capacity of over 200 horsepower, and an additional number of motors for refrigerating machinery. The contract also includes three 500-kilowatt rotary converters, transformers and switching equipment, and six 250-kilovolt-ampere transformers for the substation, to which alternating current will be supplied from the power house of the Pennsylvania Railroad. The contract for electrical work was awarded to L. K. Comstock & Company.

Thordarson Electric Manufacturing Company, 501-515 S. Jefferson Street, Chicago, has issued a bulletin, designated No. 70-A, for the use of its patrons. This six-page bulletin is prepared in suitable form for filing. The matter is illustrated and presented in six divisions. The first part pertains to Thordarson transformers, for alternating current only, and used in bell-ringing and signaling, supplanting batteries ordinarily used for these purposes. Five types of the bell-ringing transformer are illustrated; the "Junior" is for residence bells; the "3-Way" has the potential range to meet any distributing requirement; another is the special Signal transformer, adapted to use in schools, factories, mines or other places where heavy signals are necessary. The second page is devoted to this company's products in the shape of toy transformers, for toy trains and motors; also for Christmas tree lighting. The Thordarson toy rheostats are also described. This is followed by descriptions and cuts of the dash coil, marine dash coil, non-vibrating coil and other similar devices; also, steel case "Make and Break" coils, with and without switches. The Thordarson low-voltage transformer for sign lighting is one of the company's developments, as is also the A. C. regulator, and the wireless transformer of four types.

Personal and Biographical

SAMUEL LINDSEY NICHOLSON, who has been sales manager of the Westinghouse Electric & Manufacturing Company since 1909, has been promoted to the position of assistant to the vice-president, with headquarters at East Pittsburgh. Mr. Nicholson is unusually well known throughout the electrical profession because of his varied activities bringing him in contact with its numerous branches. He was born in Philadelphia, received his education in the William Penn Charter School of that city, and began his business career as an apprentice with the Belmont Iron Works in 1887. Early evincing a desire to enter the electrical business, he became associated with the Novelty Electric Works in Philadelphia the following year, and a few months later accepted a position with the Chadbourne-Hazleton Company of Philadelphia, sole sales agent for the Sprague Electric Railway & Motor Company. This company organized the Equitable Electric Railway Construction Company, and Mr. Nicholson was sent to Reading, Pa., as assistant superintendent of construction to build the Neversink Mountain Railway. Returning to Philadelphia, he was placed in charge of the sales of dynamos and motors of the Wenstrom Dynamo & Motor Company, of Baltimore, which company built the first single-reduction street railway motor and was represented at this time by the Chadbourne Hazleton Company. Appreciating the value of the experience he had gained, the young engineer was sent by the Equitable Company to Bristol, Tenn., to build the Bristol Belt Line railway. In 1892, he became connected with the Philadelphia office of the Short Electric Company and subsequently with the New York and Cleveland offices of this company. Upon the absorption of the Short Company by the General Electric Company in 1893 Mr. Nicholson accepted a position with the Technic Electric Works, Philadelphia, owned by Pepper and Register, contractors, who had the contract for the construction work incident to the electrification of a number of the street railways in Philadelphia. After a year's work as superintendent of this company, which was engaged in the manufacture of construction material, Mr. Nicholson went with James Boyd & Bros., agents for a number of mill-supply concerns, and organized for them an electric railway-supply department, catering to the street and steam railroads in the East. In 1896, he joined the forces of the Cutter Electric & Manufacturing Company, and successfully exploited for them a new circuit-breaker, patents for which they had just secured, doing considerable special work in the field, making tests before railway officials, underwriter boards, and similar bodies. A year later, he went with the C. & C. Electric Company, as sales representative in New York City, where he introduced their engine-type generators and stationary motors. In 1898, Mr. Nicholson became sales representative of the Westinghouse Electric & Manufacturing Company, in New York City, subsequently having charge of the city and industrial division of the New York office. On the reorganization of the sales department in 1904, he was made manager of the industrial department, which position he successfully filled until his selection as sales manager of the company in 1909. Mr. Nicholson is a tireless and indefatigable executive of unquestioned ability and his hosts of friends all over the country will rejoice to learn of the increased field of activities awarded him in his new position.

S. N. Nicholson.

F. J. Postel.

L. E. BARRINGER, General Electric Company, Schenectady, N. Y., delivered an interesting address on the "Mechanics of Ceramic Engineering," before the members of the New Jersey Clay Workers' Association, Trenton, June 29, at the annual summer meeting. The address covered primarily the proper drying of electric porcelain wares and the facilities installed at the General Electric Company plant for this work.

FRED J. POSTEL, of Chicago, has been appointed supervising engineer of the newly created Department of Public Works and Buildings of the State of Illinois. After serving in the Spanish-American War, Mr. Postel was associated for about six years with Charles G. Armstrong, formerly state engineer of Illinois. Since 1905 he has been engaged in consulting engineering practice, with headquarters in Chicago. His practice has extended to a great many engineering problems, particularly those of a mechanical and electrical character. He has been for several years a member of and is now chairman of the Chicago Commission on Ventilation. His new duties will deal particularly with the heating, lighting, ventilation and related features of the large number of institutional and other buildings owned by the state of Illinois. Mr. Postel is an active member and former officer of several engineering societies.

W. J. SQUIRE, manager of the Squire Electric Company, Kansas City, Mo., was seriously injured by a dynamite explosion at Leavenworth, Kans., while visiting at the home of his father-in-law, Gov. S. J. Cook of the Soldiers' Home.

A. B. ELIAS has been appointed general manager for the Southwestern Telegraph & Telephone Company, Dallas, Texas, succeeding G. A. Gates, who is vice-president. Mr. Elias, previous to this appointment, was general plant superintendent for the same company. He went to Texas from New York in 1913, where he formerly was division superintendent of plant for the New York Telephone Company.

B. W. ARNOLD recently became manager of the electric railway department of the Eastern Wisconsin Electric Company, Oshkosh, Wis. Mr. Arnold spent ten years in the service of the Illinois Traction Company, seven years of which as superintendent of the northern division. The company with which he is now connected controls public service plants at Fond du Lac, Sheboygan and Oshkosh.

Current Electrical News

WEEKLY RECORD OF CONSTRUCTION ACTIVITIES

EASTERN STATES.

BEACON, N. Y.—Fire, June 26, destroyed the electric power plant of the Southern Dutchess Gas & Electric Company, with loss of about $100,000. It is said that the plant will be immediately rebuilt. The company furnishes light and power service throughout the city and vicinity, and also for traction operation.

NEW YORK, N. Y.—Effective July 1, the New York Edison Company has placed a 7-cent lighting rate into effect, as ordered by the Public Service Commission. This rate does not include the furnishing of incandescent lamps, which are furnished under a lamp renewal agreement at one-half cent per kilowatt-hour.

SYRACUSE, N. Y.—The Jordan Electric Light & Power Company has increased its capital from $10,000 to $25,000 for extensions.

SYRACUSE, N. Y.—The Chamber of Commerce has appointed a committee to investigate the existing street-lighting conditions in the city with respect to the possibilities of municipal lighting. The contract with the Syracuse Lighting Company expires in July, 1918. E. N. Trump is chairman of the committee.

CAMDEN, N. J.—The Board of Public Utility Commissioners has granted approval for the merger of the New York Telephone Company and the Atlantic Coast Telephone Company, operating at Atlantic City and vicinity.

DOVER, N. J.—The Morris County Traction Company is planning for the early operation of its new sub-station at Mine Hill. Rotaries and other equipment are being installed. The New Jersey Power & Light Company furnishes the service at high voltage for step-down and distribution by the traction company.

GLOUCESTER CITY, N. J.—The Common Council will receive bids up to 8 p. m., July 19, for lighting the streets and highways for a period of five years with a new incandescent lighting system, effective January 1. Harry P. Johnson is city clerk.

HIGHSTOWN, N. J.—The Board of Public Utility Commissioners has granted the Electric Light & Power Company permission to issue a mortgage for $75,000 and bonds for $35,000, to be used for proposed extensions and improvements.

NEWARK, N. J.—The Board of Freeholders has given permission to the Public Service Electric Company for the extension of its transmission lines over the Lincoln Highway to furnish power for the new shipbuilding plant of the Foundation Company in this district.

POMPTON LAKES, N. J.—The Board of Public Works is considering the purchase of a water power site on Pompton Lake for the installation of a water power electric plant to serve as an auxiliary for the present steam-operated plant of the pumping and power station for city service. It is also planned to install a new engine-generator unit at the present plant.

ROOSEVELT, N. J.—The Borough Council is installing a new police call and telephone system.

WEEHAWKEN, N. J.—The West New York Town Council has awarded a contract to the Gamewell Fire Alarm Telegraph Company for the installation of new alarm equipment and stations.

HARRISBURG, PA.—The Harrisburg Light & Power Company has been granted permission to install an underground conduit system in Third Street, to be used in connection with the installation of new street-lighting standards, replacing the present arc lamps.

JOHNSTOWN, PA.—The City Council has commenced the installation of a new flash signal system for the police department.

JOHNSTOWN, PA.—The Citizens' Light, Heat & Power Company is planning for immediate construction of an ornamental street-lighting system in the business section. An underground conduit system will be installed.

PHILADELPHIA, PA.—The Philadelphia Electric Company has filed plans for the erection of a two-story, brick addition to its Tacony power station.

PHILADELPHIA, PA.—The Bureau of Water will install new water wheels, impeller type, at the Torresdale plant.

PHILADELPHIA, PA.—The Philadelphia Drying Machine Company will build a one-story power plant for factory operation at its new manufacturing plant at Westmoreland Avenue and Stokeley Street. The entire plant will cost about $40,000.

PHILADELPHIA, PA.—The Baltimore & Ohio Railroad is taking bids for the erection of a new one-story power plant, about 32 by 80 feet, at Garrett, Ind. M. A. Long, Baltimore & Ohio Railroad, Baltimore, Md., is in charge.

PHILADELPHIA, PA.—A one-story power plant for factory operation will be constructed by the DeLong Hook & Eye Company at its proposed new four-story, reinforced-concrete plant at Twenty-first and Clearfield Streets. William Steele & Sons Company, 1600 Arch Street, are architects.

PITTSBURGH, PA.—The City Council has voted to investigate the local traction situation and existing rates for electric light and gas. Bion J. Arnold, Chicago, will be engaged for the first noted; F. W. Ballard & Company, Cleveland, and C. W. Pike, Philadelphia, for the electric lighting investigation, assisted by E. M. Bemis, Chicago, and W. E. Reed, Pittsburgh; for the gas rates, Mr. Bemis will also be retained.

PITTSBURGH, PA.—A one-story power plant for works operation will be constructed by the National Biscuit Company at its new baking plant to be erected at Penn Avenue and Lambert Street. The plant will cost about $25,000. The entire factory is estimated to cost $560,000.

READING, PA.—The Metropolitan Electric Company will rebuild the electric power pant which was destroyed by fire. The new structure wil cost about $100,000.

TAMAQUA, PA.—The East Lehigh Colliery is planning for the complete electrification of the plant at a cost of about $40,000. E. M. B. Shepp is manager.

DOVER, DEL.—The Liberty Electric Corporation. Capital, $750,000. To manufacture electric machinery. Incorporators: L. B. Phillips and J. B. Bailey, Dover.

WASHINGTON, D. C.—The Department of Justice, Superintendent of Prisons, will receive bids up to July 19 for equipment for an electric lighting system and telephone system at the United States Penitentiary, Georgia.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company will build an addition to its boiler house and install additional machinery. Address A. L. Loizeau, engineer.

BALTIMORE, MD.—The United Railways Company, Continental Building, will install new stokers at its Pratt Street power station.

TOWSON, MD.—The Eastern Shore Gas & Electric Company is preparing to install additional machinery and engines for the purposes of taking care of increased contracts.

SALEM, VA.—The Eustis Electric Company will put an annex to its building and install another engine and dynamo. Address general manager.

APEX, N. C.—The City Council will receive bids up to July 11 for extensions and improvements in the electric-lighting system, consisting of a new sub-station, distributing system, arc lighting system and five miles of power transmission line. J. F. Mills is city clerk.

NEWBERN, N. C.—The Home Telephone & Telegraph Company is planning for the erection of a new three-story exchange station.

NORLINA, N. C.—The town is to have more light. The Norlina Light Company has been chartered with ample capital. Address secretary of the company.

RALEIGH, N. C.—The Palmetto Company, a subsidiary of the Carolina Power & Light Company, has commenced the construction of a new 100-mile transmission line from Wateree, S. C., to Laurinburg, N. C., connecting with the company's Yadkin River lines. The line will carry a voltage of 100,000 volts and is estimated to cost $1,000,000.

BEAUFORT, S. C.—MacDonald, Wilkins & Company are planning for the installation of an electric lighting plant on St. Helena Island.

CHARLESTON, S. C.—The Sea Island Cotton Oil Company is planning for the installation of new electric motor equipment, of 50 or 60 horsepower and smaller capacity.

AMERICUS, GA.—The Americus Lighting Company will issue $250,000 in bonds and $100,000 in stock and will purchase properties of Americus Public Service Corporation and make extensions and improvements. Address manager of the company.

ATLANTA, GA.—In a petition filed with the State Railroad Commission the Atlanta & Anderson Railway Company, which plans the construction of an Electric Railroad between Atlanta, Ga., and Anderson, S. C., asks authority to issue securities aggregating $35,000,000 for the purpose of constructing and equipping the road. The petitioners ask to be allowed to issue $7,500,000 in common stock, $7,500,000 in preferred stock and $20,000,000 in first mortgage gold bonds. The main line is to be 140 miles long, to run from Atlanta through Decatur, Chamblee, Doraville, Norcross, Duluth, Hoschton, Jefferson, Commerce, Royston and Hartwell, in Georgia, crossing the Savannah River near Brown's ferry and terminating at Anderson. In addition to the main lines, the company proposes to build a branch line from Houston through Jackson, Barrow and Gwinnett Counties, passing through Lawrenceville to Decatur, in DeKalb County. J. L. Murphey is president and Mark Bolding is secretary.

MOULTRIE, FLA.—The Moultrie Farmers' Union and the Moultrie Farmers' Association will establish a telephone line. Address manager.

NORTH CENTRAL STATES.

CHILLICOTHE, O.—The Hillsboro, Cynthiana, Bainbridge & Chillicothe Railway applied to the Public Utilities Commission for authority to issue $400,000 additional bonds to use for increased cost of construction work not provided for in a previous issue of securities. The company's right of way is along the Chillicothe cantonment site, where increased facilities are to be provided.

COLUMBUS, O.—The capitalization of East Liverpool and Steubenville Traction & Light Companies, which are subsidiary to the American Gas & Electric Company, will be reduced from $41,000,000 to $9,950,000, if a plan submitted today to the State Public Utilities Commission is approved. The Steubenville Company and East Liverpool Traction & Light Company made application to dispose of their lighting properties to the Buckeye Power Company and the traction interests are to be consolidated in the Ohio River Passenger Railway Company. It was stated that the companies have not been able to meet their interest require-

ments since 1912. The case was heard on July 6.

COLUMBUS, O.—Application was made to the Public Utilities Commission for authorization for a consolidation of the Youngstown & Sharon Street Railway Company, Mahoning Valley Railway Company, Youngstown Park & Falls Street Railway Company, Poland Street Railway Company, Mahoning Valley Southeastern Railway and the Mahoning & Shenango Railway & Light Company. These electric lines serve territory about Youngstown and Sharon, Pa. Their petition states the last named concern owns all the stock of all of them, and that for some time the roads have been operating as one system.

ELYRIA, O.—Plans are being prepared for a $50,000 building to be erected by the Elyria Telephone Company. Address local manager.

PORT CLINTON, O.—The Ottawa County Telephone Company will install a new manual system in this city. Address general manager.

TOLEDO, O.—The capital stock of the Acme Power Company was increased from $25,000 to $500,000. The Acme Company is a subsidiary of the Henry L. Doherty Company of New York, and is building the $8,000,000 power plant on the East Side. F. R. Coates is president; F. R. Frueauff, vice-president; Chris Murray secretary, and Henry L. Doherty chairman of the directors. The power supplied by the new company is to be distributed by the Rail-Light.

WOOSTER, O.—The M. W. & O. Telephone Company is placing underground all wires in the main business part of the city, a carload of conduits for six and four-duct lines, of 1,200 wires to each duct, having been received. The company's central office is soon to be in its own building, where a new switchboard will be placed. J. C. Poole is branch manager.

COLUMBUS, IND.—The filing of a petition with the Public Service Company of Indiana by the Citizens' Telephone Company, this city, for the privilege of charging toll to all of the company's exchanges in Bartholomew County from which free service is now being furnished, has started a movement for the organization of a new telephone company in the event the petition is granted.

NEW ALBANY, IND.—United Gas & Electric Company, of New Albany and Jeffersonville, holding both the electric lighting and gas franchises of the two cities, has filed notice that it is surrendering its franchises in the two cities and will hereafter operate under the provisions of the Indiana Public Service Commission. The franchises had about 12 years yet to run.

CHICAGO, ILL.—The Apex Electric Manufacturing Company has acquired 121x115 feet at the northeast corner of West Fifty-ninth and Bishop streets from four different owners. The property adjoins the plant of the company, which comprises a one-story building containing about 5,000 square feet of floor space. It is understood it will be improved.

LINCOLN, ILL.—The foreman for the Freeman Sweet Company, of Chicago, which has the contract for installing the ornamental lighting systems on Wyatt and Lincoln avenues, is in the city ready to begin work on the installation of the new lights.

BARRYTON, MICH.—Engineers B. E. Parks and Son of Grand Rapids, have been engaged to prepare plans for remodeling the electric light and power plant at Barryton.

GRAND RAPIDS, MICH.—The Grand Rapids lighting plant should be made over to afford capacity to meet the demands of the next 20 years, according to City Manager Cummin, who is making a survey of the changes necessary to increase the lighting units. He says the plant is now up to capacity, and no new street lights can be added, although several are asked.

ANSON, WIS.—The Chippewa County Telephone Company wishes to extend its lines in the town of Anson, but as the proposed extension would parallel lines of the Bell system, the matter was taken to the State Railroad Commission.

APPLETON, WIS.—The power house of Wisconsin Traction, Light, Heat & Power Company was damaged by fire, caused by a stroke of lightning. The fire so damaged the generator and connecting cables that power and light were cut off about four hours. The damage is estimated at $5,000.

DATES AHEAD.

New England Section, National Electric Light Association. Annual convention, New London, Conn., September 11 to 14. Secretary, Miss O. A. Barsiel, 149 Tremont Street, Boston, Mass.

Northwest Section, National Electric Light Association. Annual convention, Spokane, Wash., September 12 to 15. Secretary, J. F. Farquhar, Washington Water Power Company, Spokane, Wash.

American Electrochemical Society. Annual convention, Pittsburgh, Pa., October 3 to 6. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

National Electrical Contractors' Association of the United States. Annual convention, New Orleans, La., October 10 to 13. Secretary, H. C. Brown, Utica, N. Y.

FLORENCE, WIS.—Peninsula Power Company has begun work on its proposed dam and power-house, two miles from Florence, on Brule River. J. R. McDonald has charge of construction work for the company.

MADISON, WIS.—Negotiations for purchase by the Wisconsin Interurban System of the two and one-half miles of track between Fair Oaks and the town hall of Blooming Grove are in progress with the receiver of the Janesville & Madison Traction Company.

MADISON, WIS.—The Railroad Commission of Wisconsin has authorized the Peninsula Power Company to issue $157,100 common stock and $225,000 in 8 per cent notes, to be exchanged for present outstanding 8 per cent preferred stock, to be sold to secure funds for construction of a hydro-electric station on the Brule River in Wisconsin, and for the construction of additions and extensions to its system in Florence County. Address F. E. Turneaure, secretary-treasurer, 305-108 State Street, Madison, Wis.

MILWAUKEE, WIS.—The Wisconsin Telephone Company will spend approximately $1,000,000 on new buildings and improvements in its service in Wisconsin, within the next few months. At the recent meeting of the board of directors in Milwaukee expenditures amounting to $342,343 covering additions to and repairs on Milwaukee plants and expenditures amounting to $643,548, covering additions and repairs in the state, were approved. A new branch, which will act as an exchange for the East Milwaukee subscribers and upper east side, is to be erected in the northeast section of Milwaukee. An addition will be erected to the present west exchange. In Racine a new exchange building will be erected, and throughout the state changes will be made at various offices. The directors who attended the meeting were: C. Jay French, Boston; B. E. Sunny, Alonzo Burt and H. F. Hill, Chicago; Otto H. Falk, Julius O. Frank, O. C. Fuller and H. O. Seymour, Milwaukee.

MONTICELLO, WIS.—An election was held July 5 for voting a bond issue of $5,650 for electric lighting system. Address town clerk.

NIAGARA. WIS.—W. S. Shields, engineer, 8 South Dearborn Street, Chicago, was selected to make plans for water and sewerage system, artesian wells and elevated steel tank, to cost $25,000.

OSHKOSH, WIS.—Eastern Wisconsin Electric Company, which controls public service plants at Oshkosh, Fond du Lac and Sheboygan, may spend $500,000 rehabilitating the system at Fond du Lac, $200,000 improving facilities at Oshkosh, and a like sum at Sheboygan.

TOMAHAWK, WIS.—Towahawk Rural Telephone Company will probably extend its lines to serve a number of prospective customers. V. E. Extrom, secretary.

ST. JAMES, MINN.—J. H. A. Brantz, Mankato, consulting engineer, has been commissioned to make plans for a water tower, 110 feet high, of 225,000 gallons capacity.

WADENA, MINN.—The Aldrich and Verndale telephone line has been incorporated with $600. George K. Castle, president.

ELLSTON, IA.—The Mount Ayr Light & Power Company has been granted a franchise to supply Ellston with electricity. Address H. H. Tedford, secretary, Mount Ayr.

JERICO, IA.—The Jerico Telephone Company has been incorporated with $3,000 capital. M. H. Nelson, manager.

LE MARS, IA.—The Iowa Heat, Light & Power Company has purchased a site and will erect a power plant to supply Plymouth with electricity.

MUSCATINE, IA.—The electric light company was granted permission to extend its underground conduits west past reservoir. Address general manager.

MUSCATINE, IA.—Plans have been outlined for the electrification of the Muscatine, Burlington & Southern Railway within the next few months. The road will be completely rehabilitated at an expense of approximately $200,000.

WAPELLO, IA.—The Yapello electric light plant was completely destroyed by fire, the loss being estimated at $10,000. Address manager.

FREDERICKTOWN, MO.—The disposition of the municipal light plant is under consideration. The Public Utilities Commission has indicated that it is in the market for the plant, and the Union Electric Company of St. Louis are said to be considering it also.

ST. JOSEPH, MO.—Bonds to the amount of $165,000 will be voted on shortly for a city lighting plant.

BUNKERHILL, KAN.—The question of building a municipal light plant is under consideration.

DOWNS, KAN.—The purchase of the Solomon Valley Power plant by A. E. Fitkin & Company, Chicago, has been confirmed by the State Utility Board and the new owner took charge of the property on July 1.

FORT RILEY, KAN.—Fred B. Uhrig, manager of the Western Electric Company, Kansas City, Mo., has been advising with the army officers and electric companies in regard to the installation of a complete electric system for the lighting of the new buildings which are being rushed to completion. According to Mr. Uhrig, the Government is making arrangements to use at least 1,000 kilowatts over the lines entering the fort.

GALENA, KAN.—Plans and specifications for a new city water system are desired by the City Council. Engineers will be asked to submit estimates for a deep-well system.

GARFIELD, KAN.—The building of a transmission line from Larned to this city is under consideration.

HALSTEAD, KAN.—A petition for street lights at Third, Fourth and Walnut Streets is being considered by the council.

HIAWATHA, KAN.—Improvements of the street lighting system of this city are being considered by the Community Commercial Club. The addition of new and larger lights, early morning service during the winter months or continuous service was discussed.

LECOMPTON, KAN.—The enlargement of the electric light plant and the reorganization of the commercial lighting system on a paying basis is being considered.

SALINA, KAN.—The United States Automatic Fire Alarm Company, which recently received a franchise from the city, will erect a building and install a system at an expenditure of $40,000, to be completed within the year.

WICHITA, KAN.—The Kansas Gas & Electric Company will expend $500,000 for improvements in this locality. Address L. O. Ripley, general manager.

AVOCA, NEB.—$5,000 in bonds have been voted for electric light system. Address town clerk.

BENKELMAN, NEB.—The sum of $1,200 is to be used in making improvements in the wiring of the main leads from the light plant.

INDIANOLA, NEB.—The proposition of issuing $22,800 for water works system carried at election. Address city clerk.

LINCOLN, NEB.—The Meyer Hydro-Electric Power Company has been granted authority by the State Railway Commission to issue common stock in the amount of $50,000, the proceeds to be used in reimbursing the promoters for money spent in establishing a hydro-electric power plant on the Little Blue River near Oak with transmission lines to Davenport, Edgar, Ruskin and Carleton.

BONESTEEL, S. D.—Engineers Bruce and Standeven, of Omaha, Neb., have prepared plans for the installation of a lighting system. Address town clerk.

PIERRE, S. D.—Articles of incorporation have been filed for the Fairview Rural Telephone Company at Garretson. Capital, $22,000. Incorporators: A. J. Munson, Lewis Eliefson, Chris J. Loftness.

SOUTH CENTRAL STATES.

ASHLAND, KY.—This city has begun the installation of a modern street lighting system. At a meeting of the City Council $5,000 was appropriated for use in the downtown district. The same plan through the entire city will be followed as fast as the money can be raised, covering 37 miles of paved streets. The Chamber of Commerce is back of the improvements.

HARDINSBURG, KY.—The Hardinsburg Electric Light Company is said to be planning for the erection of a new plant.

HUMPHREY, KY.—The Casey County Farmers' Telephone Company has been incorporated with $500 capital. John M. Floyd, manager.

LA GRANGE, KY.—Differences between the city of La Grange, Ky., and S. R. Schaff & Company, who operated the lighting plant, have been settled by the Kentucky Utilities Company taking over the property and contracting to light the streets until the end of the year at $75 a month. After that time the utilities company has a franchise.

LOUISVILLE, KY.—Service to the site of the Federal Army Camp being established south of the city, has been provided in short order by the Louisville Gas & Electric Company. At the request of the general contractor on the job, the Mason & Hanger Company, the feed wires were extended on the rush construction plan and flood lighting is now being supplied for night construction work.

WHITESBURG, KY.—The Caudill Coal Company is planning for the installation of new electric equipment for operation. L. W. Fields is manager.

CHARLESTON, TENN.—John N. Adams, engineer, is in the market for machinery for a hydro-electric plant of 1,800 horsepower for electric lighting and an electric railway.

CHATTANOOGA, TENN.—The Pulaski Electric & Water Company has been incorporated with capital stock of $50,000 by George B. Adams, S. W. Alley, C. O. Lindsay, George W. Erwin and J. C. Stickney. The company proposes to develop water power and construct light and power plants and water works.

FAYETTEVILLE, TENN.—Fayette-Electric Light & Power Company. Capital, $60,000. To operate a local plant and system. Incorporators: Wm. H. Smith, H. K. Bryson and W. J. Bunn.

CHATTANOOGA, TENN.—The Tennessee Paper Company, recently incorporated, is planning for the electric operation of its proposed new mill, to cost about $150,000. John Stagmaier is head of the company.

BIRMINGHAM, ALA.—The Commission is preparing to make a further extension of its North Birmingham light plant. By the latest extension planned the lines will be run from West Park, through Third Alley and between the city hall and the Third Avenue Fire Station. The cost, as estimated by City Electrician Abernethy, will be about $900. Besides this, it is believed the city would take over most of the commercial light on First, Second and Third Avenues. The Commission also is considering running its lines from East Park to First Avenue and lighting all the intervening business section in that district.

ROBERTSDALE, ALA.—The Robertsdale Feed Mills is planning for the erection of a new electric plant. J. A. Baldwin is manager.

PINE BLUFF, ARK.—A contract is to be drawn up with the electric light company which will provide for lighting the White Way.

ARDMORE, OKLA.—Improvements of the local branch of the Pioneer Telephone Company are being considered by officials of the company.

KENEFICK, OKLA.—Election to grant a franchise to W. A. Baehr and associate to transmit electric current to Kenefick, carried.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company has increased its capital stock from $5,100,000 to $50,000,000. It is announced that the proceeds from the sale of these additional shares will be used to construct a large electric power plant in East Oklahoma, and the building of an extensive system of transmission lines. The company owns the light and power plants at Oklahoma City, Shawnee, Muskogee and several other towns of this state. H. M. Byllesby & Company of Chicago are managers of the company.

STILLWATER, OKLA.—A $6,000 bond issue for purchasing a new boiler for the light plant will be voted on shortly.

TULSA, OKLA.—The Pioneer Telephone Company will commence immediately the installation of another exchange in the Tulsa office to be completed in the fall. This will enable the company to practically double its service.

WAYNOKA, OKLA.—Bonds to the amount of $26,000 have been voted for the erection of a light and power plant and the purchase of new engines. Construction will start immediately.

BEEVILLE, TEX.—An electric motor pump to elevate the water from the sewer disposal plant will be purchased by Mayor C. E. Williams.

DALLAS, TEX.—J. F. Strickland and C. W. Hobson, who represent the owners of the street railway systems and electric light plants here, to whom the city granted franchises for a merging of these properties and which franchises were approved by a referendum vote of the people last April, have been granted an extension of time to September 27, in which to accept the franchises. In a public statement Messrs. Strickland and Hobson said that litigation has delayed their acceptance of the franchises.

DALLAS, TEX.—The Texas Electric Company, which operates a system of interurban lines radiating out of Dallas, will erect an express building here, to cost $50,000.

DALLAS, TEX.—City Building Inspector H. J. Emmins has commenced plans and specifications for a water tank to supply the proposed municipal prison farm. The tank will have a capacity of 40,000 gallons and water for it will be pumped by electric power.

EL PASO, TEX.—The El Paso Electric Railway Company has applied to the City Council for a franchise to build a branch line from Hague Street, out Campbell Street to Kern Place.

FORT SAM HOUSTON, TEXAS.—The Stone & Webster Engineering Corporation, of Boston, Mass., which was awarded the contract by the Council of National Defense, upon approval of the Secretary of War, for the erection of cantonments here for the accommodation of about 40,000 soldiers, at an estimated cost of about $3,500,000, will also install a complete electric lighting system for the new army city.

FREEPORT, TEXAS.—The Freeport Sulphur Company, owned by the Swenson syndicate of New York, is making a survey for a proposed interurban electric railway, to be constructed between Freeport and Houston, via Rosenburg and a number of other towns, a distance of about one hundred miles. It is stated the contract for building the railway will be awarded as soon as the survey is finished and the right of way obtained. The surveying party is in charge of W. A. Randle, engineer of the Freeport Sulphur Company. It is planned to utilize the waste power of the big steam plant at the sulphur mines of the company, near here, to generate electrical energy for operating the railway.

SAN ANTONIO, TEX.—The San Antonio Traction Company and the San Antonio Gas and Electric Company are to be merged into a new corporation called the San Antonio Electric Company. It is stated by W. B. Tuttle, vice president of both companies, that as soon as the proposed merger is effected the new company will enter the interurban railway field. Its first line will run between San Antonio and the Government aviation station, a distance of about three miles from the present terminus of the track, running in that direction. The new corporation will have a capital stock of $4,700,000. It plans to build an interurban electric line between San Antonio and Austin, a distance of 82 miles.

TAYLOR, TEX.—The office of the Southwestern Telephone Company was damaged by fire to the extent of $10,000, June 18.

VICTORIA, TEX.—The City Council granted the Texas Gas & Electric Company a hearing on the proposition of requiring all service wires to be placed underground, on paved streets. The company gave reasons for not complying with the requirement, but offered to remove the poles on Main Street by stringing its wires in cables along the buildings. Plans for erecting a white way were taken up and discussed. The Southwestern Telegraph & Telephone Company was granted a hearing on the underground proposition.

WESTERN STATES.

TERRY, MONT.—A. A. Jackson, of Wheaton, Minn., purchased the Terry electric light plant and took charge on July 1.

WESTBY, MONT.—The Westby Telephone Company has been incorporated with $10,000 capital. John K. Borg and A. T. Olsen are incorporators.

STRASBURG, COLO.—The Wolf Creek Telephone Company has been incorporated with $1,250. Benjamin J. Hansel, manager.

PHOENIX, ARIZ.—The Pacific Gas & Electric Company of Phoenix has been granted authority by the State Corporation Commission to issue $555,000 bonds, the proceeds of which are to be used in making extensions of its street railway system, enlarging its electric power plant and making other improvements.

YUMA, ARIZ.—The Arizona-Mexico Land Company is preparing to pump water upon 17,000 acres of mesa land south of Yuma. This will require the installation of a 3,000-norsepower pumping plant located on the east bank of the Colorado River above Prison Hill, to lift the water to a reservoir from which the service mains will radiate.

YUMA, ARIZ.—E. F. Sanguinetti and F. L. Ewing have applied for an electric light and power franchise in this city. The question will be decided at an election to be held July 19.

BOVILLE, IDAHO.—The electors have voted to issue bonds to the amount of $o,500, the proceeds to be used in installing an electric lighting plant.

TROY, IDAHO.—The Troy Rural Telephone Company has changed its name to the Troy Telephone & Electric Company.

WALLACE, IDA.—City Council has notified the telephone company that its poles must be removed to line before the paving work is completed, otherwise action will be taken to eliminate all poles and place wires in underground conduits.

NORTH YAKIMA, WASH.—The warehouse and workshop of the Pacific Power & Light Company of this city was burned recently.

OLYMPIA, WASH.—Thurston County Commissioners recently granted a petition for franchise to the Puget Sound Traction Light & Power Company, asking for an extension of the transmission line from Brown's ranch to Log Cabin in this place. The line will be used in conjunction with the Olympic Power & Light Company, in supplying electric power to shipyards.

PORT ANGELES, WASH.—A special election has been called to vote on a proposition to issue $30,000 in bonds, the proceeds to be used in retiring outstanding warrants of the electric lighting department and for extensions and betterments to the lighting system.

SEATTLE, WASH.—Preparations are being made for extension of the city's street car service on Fourth Avenue. An ordinance will be introduced calling for purchase of 16 one-man cars and four additional large cars.

TACOMA, WASH.—Ordinance has been introduced in the City Council authorizing the issuance of city utility bonds in the sum of $180,000 to build and equip the 11th Street municipal street car line to the east side of the bay to connect with the shipyards.

MYRTLE CREEK, ORE.—A special charter election has been called preliminary to the construction of a municipal power, light and water plant.

BLYTHE, CAL.—The Railroad Commission of California has authorized the Southern Sierra Power Company to construct an electric generating plant and distributing system here, at an estimated cost of $20,000.

COVINA, CAL.—The California Railroad Commission has authorized the Home Telephone Company of Covina to issue bonds to the amount of $6,000 for

improvements in the trunk lines between Azusa and Covina and between Covina and Puente.

CROCKETT, CAL.—Work has been started on the new power station of the Great Western Power Company at this place.

FULLERTON, CAL.—Construction on the Pacific Electric Railway line into this city will start from this end at once.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Corporation, the Southern California Edison Company and the Southern California Gas Company have filed with the California Railroad Commission an application for authority to charge an initial deposit of more than $2.50 for dometic service.

LOS ANGELES, CAL.—The Southern California Edison Company and the city of Azusa have filed a joint application with the California Railroad Commission for authority for the Edison Company to sell to the city of Azusa several of its lines in that city.

LOS ANGELES, CAL.—Sealed bids are being received by the Board of Public Service Commissioners for copper cables and wires for the Department of Electricity.

LOS ANGELES, CAL.—The City Council has advertised for bids for city lighting for the ensuing year.

LOS ANGELES, CAL.—Plans are being made by the Hill Street Improvement Association for an ornamental lighting system.

MURPHYS, CAL.—The Burnsted mine is to be equipped with an electric hoist.

OROSI, CAL.—The Farmers' Telephone Company has been reorganized and about $4,000 will be spent in rebuilding lines. Extensions will be made into new districts east of Orosi.

PASADENA, CAL.—The city of Pasadena has filed a complaint against the Southern California Edison Company, asking the California Railroad Commission to fix proper rates to be charged for electricity in South Pasadena and Los Angeles, and to compel the company to cease discrimination in its charges.

SALINAS, CAL.—Sealed bids are being received by the clerk for the installation of an electrolier lighting system of 50 electroliers on Main Street.

SAN DIEGO, CAL.—Six hundred thousand dollars is available for installing lighting, water and sewage systems for the brigade post which is to be established on the tide lands abutting on the Point Loma boulevard.

SAN DIEGO, CAL.—The San Diego Home Telephone Company has been ordered by the California Railroad Commission to charge its established rates to all persons without discrimination and to enforce its rules in all cases.

SAN FRANCISCO, CAL.—Frank Pellister and E. S. Moore have filed an application with the Railroad Commission of California for permission to operate a telephone and telegraph system in Mono county.

SAN JOSE, CAL.—The old magnetite lamps in this city are to be supplanted by 120 new lamps of 250 candlepower.

WATSONVILLE, CAL.—The Pacific Telephone & Telegraph Company has applied for a franchise in this city.

PROPOSALS

ELECTRICAL APPLIANCES AND EQUIPMENT—Bureau of Supplies and Accounts, U. S. Navy Department, Washington, D. C., will receive bids, at early dates not yet specified, for the following electrical equipment and supplies: 10 vibrating bells, water-tight; 175 push buttons; 200 20-volt salvo-firing buzzers; 60 non-water-tight, 20-volt buzzers; 1,000 interior fittings; 1,800 portable, non-water-tight guards; 2,500 shade holders; 100 lbs. mica, clear, uncut grade "A-1"; 3 motor-generator sets, furnishing and installing; 4,250 key sockets, bronze, brass; 3,000 screws for 5-ampere switch handles; 850 snap switches. All above for delivery at Puget Sound Navy Yard, except the 3 motor-generator sets, which are for delivery at Washington, D. C., Navy Yards. Intending bidders should apply to Bureau for copies of schedules.

ELECTRICAL SUPPLIES—Sealed bids will be received by the Commissioner of Gas and Electricity at his office, Room 614, City Hall, Chicago, July 10, for furnishing and delivering to the City of Chicago, Department of Gas and Electricity, electric light cable, strictly in accordance with plans on file in the office of the Commission, in the following approximate amounts: 116,000 feet of 8-conductor, paper-insulated, lead-covered, No. 8, B. & S. G., 5,000-volt cable; 54,000 feet of 4-conductor, paper-insulated, lead-covered, No. 8, B. & S. G., 5,000-volt cable; 24,500 feet of 3-conductor, paper-insulated, lead-covered, No. 2, B. & S. G., 12,000-volt cable Alternate proposals will also be received on each of the above items, substituting a rubber insulation for the paper insulation. Proposals must be made out upon blanks furnished by the Commissioner of Gas and Electricity. Address William G. Keith, Commissioner of Gas and Electricity.

INCORPORATIONS

HEMPSTEAD, L. I., N. Y.—The Peterson Storage Battery Company. Capital, $10,000. To manufacture storage batteries. Incorporators: C., J. H. and A. Peterson, Hempstead.

NEW YORK, N. Y.—Jessemere Constructing & Contracting Company. Capital, $100,000. Electrical construction. Incorporators: A. Hallow, S. W. Weber and R. S. Davidson, 227 Riverside Drive.

BROOKLYN, N. Y.—W. B. Perry Electric Company. Capital, $75,000. Electrical engineering and contracting. Incorporators: W. B. Perry, V. V. Shorey and G. B. Smith, 55 Liberty Street.

JERSEY CITY, N. J.—The Charles V. Hoffman Company. Capital, $25,000. To manufacture electric equipment, boiler room products, etc. Incorporators: C. V. Hoffman and L. W. Guernsey, Bound Brook, and C. F. Payton, Flemington.

PITTSBURGH, PA.—Lighting Specialties Company. Capital, $10 000. To manufacture electric lighting specialties. Harold Kirschberg, principal incorporator.

PHILADELPHIA, PA.—The Ralph R. Lewis Company. Capital, $25,000. Electrical engineering. Incorporators: F. R. Hansell, Philadelphia; J. Vernon Pimm and S. C. Seymour, Camden, N. J.

CLEVELAND, O.—The Trelectric Manufacturing Company, Cleveland. Capital, $25,000. Electrical appliances. Incorporators: Wm. C. Pregonning, J. A. Boyden, W. K. Stanley, Fred Young, H. N. Pettibone.

MILWAUKEE, WIS.—Sorgel Electric Company, Milwaukee. Capital stock, $25,-000. Incorporators: W. R. Sorgel, Frank L. Fawcett, Paul R. Newcomb.

WILMINGTON, DEL.—Herchie Electric Motor Corporation. Wilmington, Del. Capital, $100,000. Incorporators: C. L. Rimlinger, Henry M. Robinson, Clement M. Egner, Wilmington.

OKLAHOMA CITY, OKLA.—Nunn Electric Sign System, Inc., Oklahoma City. Capital, $5,000. Incorporators: J. E. Nunn, Amarillo, Texas; D. W. Mays, W. L. Carloss, Oklahoma City.

LEADBELT, MO.—Leadbelt Telephone Company of Leadbelt, St. Francois County. Filed a statement showing increase of capital stock from $75,000 to $125,000.

AKRON, O.—The Ohio Electric Construction Company, Akron. Capital, $5,000. Incorporators: James B. Conley, M. N. P. Mitchell, E. H. Clinedinet, J. J. Mulrain and H. O. M. Smith.

CHARLESTON, ILL.—Application was filed with Secretary of State, Springfield, for incorporating of Burback Electrical Company, Charleston. Capital, $1,000. Incorporators: A. W. Burback, Irene Burback and Melvina Burback.

CHICAGO, ILL.—United States Electrical Supply Company, Peoria. Capital, $100,000. Incorporators: J. A. Arenz, Louis C. Crawley, H. G. Page.

NEW YORK, N. Y.—The Electric Control Company. Capital, $10,000. To operate an electrical contracting business. Incorporators: F. P. Fahe, J. G. Acheves and G. J. Gillespie, 146 East Seventy-second Street, New York.

NEW YORK, N. Y.—The A. B. C. Arc Lamp Company. Capital, $20,000. To manufacture arc lamps for motion picture and other service. Incorporators: W. and M. Bacn, and W. A. Cunningham, 4025 Lowrie Place, Bronx.

PHILADELPHIA, PA.—The Laurel Run Light, Heat & Power Company. Nominal capital, $5,000. To operate electric properties at Laurel Run. Also, the Oneida Light, Heat & Power Company, with same capital and officials, to operate at Oneida. John E. Zimmerman is treasurer of both companies.

PHILADELPHIA, PA.—Rumsey Electric Company. Capital, $325,000. To operate electric properties in Pennsylvania. George A. Rumsey is the principal incorporator.

READING, PA.—The Bowers Electric Company. Nominal capital, $5,000. To operate local electric properties. W. J. Martin, Topton, treasurer.

SCRANTON, PA.—The Brady Township, Banks Township, Henderson Township, Gaskill Township, Sandy Township, Washington Township, Snyder Township and Young Township Electric companies. Each with nominal capital of $5,000, to operate electric properties in the respective townships. John P. Rawson is treasurer of the companies.

WYOMISSING, PA.—Hereford Township Electric Company. Nominal capital, $5,000. To operate in Hereford Township. Also, the Washington-Berks Electric Company, with same capital and officials, to operate in Berks County. A. L. Hart is treasurer of both companies.

DOVER, DEL.—The Eastern Montana Light & Power Company. Capital, $420,-000. To operate electric light and power properties in Montana. Incorporators: Miles J. Hall, Harry H. Phillips, Charles J. Horn, Burrell J. Kramer, Frank Conrad and Clarence A. Flinn, Chicago, Ill.

ASHTABULA, O.—The Ashtabula Electric Service Company, Ashtabula; $15,000; R. A. Wentz, W. H. Murbach, E. H. Wentz, J. E. Murbach and Hazel Wentz.

ALVA, OKLA.—The Southwestern Utilities Company has been incorporated by Albert Emanuel, Dayton, O.; Noel R. Gascho, Alva, Okla.; W. A. Parr, Alva, Okla. Capital, $500,000.

CLEVELAND, O.—The Willis Electric Company, Cleveland; $15,000. Willis W. Hale, C. W. Hale, A. R. Hale, D. E. Read and Victor C. Lynch.

COLUMBUS, O.—The Columbus, Delaware & Marion Electric Company, Columbus; $1,000. Samuel L. Finn, Daniel Blau, I. Webb, Ira Crawford and M. F. Sheeler.

FAYETTEVILLE, TENN.—The Fayetteville Electric Power & Light Company has been incorporated with $60,000 capital by H. Knox Bryson and W. J. Bunn.

ST. JOE, IND.—The St. Joe Telephone Company has been incorporated with $10,-000. E. A. Geauque, manager.

GILLESPIE, N. J. — T. A. Gillespie Company. Capital, $500,000. Incorporated in Delaware to engage as electrical engineers. Incorporators: Thomas H. Gillespie, H. S. Morrow and R. A. Johnston, New York. B. W. Stevens, agent.

DOVER, DEL.—American Lamp Company. To manufacture electric lighting fixtures. Incorporators: Joseph E. and Harold B. Parker and Everett P. and Harold F. Collins.

DOVER, DEL.—Hercules Electric Motor Corporation. Capital, $100,000. To manufacture electric motors. Incorporators: C. L. Rimlinger, Henry L. Robinson, Wilmington, Del., and Clement N. Egner, Elkton, Md.

NORLINA, N. C.—Norlina Light Company. Capital, $10,000. To operate a local light and power system. Incorporators: W. E. Pratt, T. D. Peck and H. C. Fleming.

NEW YORK, N. Y.—World Harvester Corporation. Capital, $1,500,000. Incorporated in Delaware to manufacture electric-driven harvesting equipment. Incorporators: D. Halley Barber, Herbert E. Monahan and R. Freckman, New York.

NEW YORK, N. Y.—New Home Gas & Electric Supply Company. Capital, $50,-000. To manufacture electric and gas fixtures. Incorporators: E. London, H. Kupferberg and L. Ruderfer, 598 Van Siclen avenue, Brooklyn.

NEW YORK, N. Y.—Pioneer Engineering Corporation. Capital, $25,000. To manufacture portable electric lamps. H. C. and D. C. Conkling and E. W. Picker, incorporators, 80 Maiden Lane, New York.

NEW YORK, N. Y.—Witherbee Storage Battery Company. Capital, $10,000. To manufacture storage batteries. Incorporators: C. Staudt, C. and P. Meder, 990 First avenue, New York.

FINANCIAL NOTES

The Nevada-California Corporation has declared a dividend of $1.50 a share on the outstanding preferred stock, payable July 30, to stock of record June 30, covering the accumulated dividend on the preferred stock to July 1.

A special stockholders' meeting of Southern California Edison Company has been called for July 13, 1917. At the meeting held on April 5, 1916, the stockholders authorized a new refunding trust deed for $100,000,000, but owing to changes in the financial situation due to the war, the authorization thus given was not exercised and the authorized bonded debt of the company is now the same as then, $36,000,000.

The directors now deem it necessary to carry out the action contemplated at the meeting of April 5, 1916, and to increase the authorized bonded debt of the company to $136,000,000 by the authorization of a new refunding trust deed in the amount of $100,000,000.

The consolidation of this company with Pacific Light & Power Corporation has now been completed and the financial requirements of the enlarged corporation can only be satisfactorily met in the manner proposed.

The annual report of the Middle West Utilities Company for the year ended April 30, 1917, shows earnings of $1.61 on the 95,937 common shares outstanding as compared with earnings in the previous year of $3.50 on 90,503 shares outstanding. Higher operating costs are held responsible for the lower net earnings, though the increase in gross showed a satisfactory expansion of business.

During the year ended April 30, 1917, the company acquired the Kentucky Light & Power Company, the Central Power Company of Nebraska, the Citizens' Gas Light Company of Jackson, Tenn., and the Houghton County Gas & Coke Company of Houghton, Mich.

In an application to the Illinois Public Service Commission made by the Rockford Electric Company, a subsidiary of the American Gas & Electric Company, the company urges the substitution of sliding scale power rates for the existing fixed rates.

The plan offered provides that "for each 5 cents decrease in the average monthly cost of coal below $1.75 a ton, f. o. b. cars on the power plant switch track, there will be deducted each month from all net bills, based upon power schedules to which this schedule is supplementary, one-tenth of a mill per kilowatt-hour.

"For each 5 cents increase above $2.25 per ton there will be added one-tenth of a mill per kilowatt-hour."

The Railroad Commission of California has authorized the Western States Gas & Electric Company, a subsidiary of Standard Gas & Electric, to use $116,993 of the proceeds from the sale of its $1,564,000 of ten-year 6 per cent debentures during the months of August, September, October and November, 1917. The commission's order further provides that $312,474 of the proceeds of the debentures may be issued to pay for construction expenses incurred during the year ending November 30, 1917.

The Southern California Telephone Company, the Home Telephone & Telegraph Company and the Pacific Telephone & Telegraph Company have filed with the California Railroad Commission a joint application for authority for the Southern California Telephone Company to issue to the Pacific Telephone & Telegraph Company $786,000 capital stock; for approval of the delivery by the Southern California Telephone Company to the Home Telephone & Telegraph Company of $355,000 bonds, and for permission for the Pacific Telephone & Telegraph Company to acquire from the Southern California Telephone Company $786,000 of the latter's stock.

Suit to prevent the statute of limitations running against $3,600,000 worth of Oakland Railways and Oakland Terminal Company notes has been filed by the Anglo-California Trust Company and others against the Oakland Terminal Railways and several hundred banks, corporations and private individuals.

Shawinigan Water & Power Company declared the regular quarterly dividend of 1¾ per cent on the capital stock, payable July 10. Books do not close.

Chicago City Railway declared the regular quarterly dividend of 2 per cent, payable June 30 to stock of record June 25.

New England Telephone & Telegraph Company declared regular quarterly dividend of $1.75 a share, payable June 30 to stock of record June 20.

Reports of Earnings.

APPALACHIAN POWER COMPANY.

Comparative statement of earnings and expenses for the month of May is as follows:

Month of May:	1917.	1916.
Gross earnings	$74,563.78	$65,635.03
Operating expenses and taxes*	28,400.13	31,048.44
Net earnings	46,163.65	34,586.64
Other income	83.36	622.35
Total income	46,247.01	35,208.99
Operating ratio	38.1%	47.3%
Twelve mos. ended May 31:	1917.	1916.
Gross earnings	$841,256.66	$710,025.66
Operating expenses and taxes	364,840.60	321,127.25
Net earnings	476,416.06	388,898.41
Other income	2,470.97	1,978.05
Total income	478,887.03	390,876.46
Bond interest	283,361.41	272,616.56
Note interest	162,602.49	153,696.85
General interest.....	14,041.22	10,035.34
Less interest charged to construction**		110,515.65
Net income	18,881.91	65,043.26
Operating ratio	43.3%	45.2%

*Decrease.

**No interest has been charged to this account since March, 1916.

CUMBERLAND COUNTY PR. & LT.

Report of earnings of Cumberland County Power & Light Company and subsidiary companies for May and twelve months ended May 31 compares as follows:

	1917.	1916.
May gross .....$	236,728	$ 223,420
Net after taxes.....	62,010	86,992
Balance after charges.	*5,975	20,767
Surplus after pfd. divs	*17,475	9,267
12 months' gross.....	2,973,215	2,736,122
Net after taxes.....	1,041,236	1,125,823
Balance after charges.	228,805	331,669
Surplus after pfd. divs.	90,805	193,669

*Deficit.

CITIES SERVICE.

Comparative statement of earnings as of May 31 of the Cities Service Company is as follows:

	Twelve months ending May 31, 1917.	May 31, 1916.
Gross earnings..$	15,218,272.65	$6,012,908.67
Expenses	287,038.12	201,343.52
Net earnings...$	14,931,234.53	$5,811,625.15
Interest on notes and debentures	42,624.37	503,453.85
Net to stock.....$	14,888,610.16	$5,308,171.30
Divs. preferred stock	3,038,169.65	1,759,547.42
Net to common stock and reserves .....$	11,850,440.51	$3,548,623.88

	Month of— May, 1917.	May, 1916.
Gross earnings....$	1,565,425.54	$709,085.22
Expenses	28,340.63	20,112.59
Net earnings ....$	1,537,084.91	$688,972.63
Interest on notes and debentures..	234.52	44,120.89
Net to stock.....$	1,536,850.39	$644,851.74
Divs. preferred stk.	299,124.50	171,355.00
Net to common stock and reserves .....$	1,237,725.89	$473,496.74

Contingent fund .....$	734,186.23
Surplus reserve	2,329,668.04
Stock surplus	5,565,505.00
Surplus	8,383,775.34
Total surplus and reserves.$	17,013,134.61

	1917.	1916.
Number of times preferred dividend was earned.....	4.90	3.02
Per cent earned on average amount of common stock outstanding .....$	53.48	21.98

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRIC COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate per cent.	Bid June 26.	Bid July 3.
Adirondack Electric Power of Glens Falls, common	..	20	18
Adirondack Electric Power of Glens Falls, preferred	6	73½	73½
American Gas & Electric of New York, common .....10+extra		118	116
American Gas & Electric of New York, preferred	6	47¾	48
American Light & Traction of New York, common	..	328	319
American Light & Traction of New York, preferred	6	110	109
American Power & Light of New York, common	4	66	67
American Power & Light of New York, preferred	6	87	87
American Public Utilities of Grand Rapids, common	..	28	28
American Public Utilities of Grand Rapids, preferred	6	59	64
American Telephone & Telegraph of New York	..	123	120⅛
American Water Works & Elec. of New York, common	..	7¾	8
American Water Works & Elec. of New York, particip.	7	23	23
American Water Works & Elec. of New York, first preferred...	..	76	76
Appalachian Power of Bluefield, common.....	..	5	5
Appalchian Power of Bluefield, preferred.....	7	30	30
Cities Service of New York, common.....6+extra		283	277
Cities Service of New York, preferred.....	6	86¼	85
Commonwealth Edison of Chicago.....	8	.....	122
Comm. Power, Railway & Light of Jackson, common	4	48	47
Comm. Power, Railway & Light of Jackson, preferred	6	75	75
Federal Light & Traction of New York, common	..	13	11½
Federal Light & Traction of New York, preferred	..	44	43
Illinois Northern Utilities of Dixon.....	6	78	78
Middle West Utilities of Chicago, common.....2+2 extra		40	40
Middle West Utilities of Chicago, preferred.....	6	69	70
Northern States Power of Chicago, common	7	96	96
Northern States Power of Chicago, preferred	7	97	97
Pacific Gas & Electric of San Francisco, common	5	58	56
Pacific Gas & Electric of San Francisco, preferred	6	89	88
Public Service of Northern Illinois, Chicago, common	7	93	93
Public Service of Northern Illinois, Chicago, preferred	6	96	98½
Republic Railway & Light of Youngstown, common	4	35	35½
Republic Railway & Light of Youngstown, preferred	6	67½	67½
Standard Gas & Electric of Chicago, common	..	11	9½
Standard Gas & Electric of Chicago, preferred	6	35	34
Tennessee Railway, Light & Power of Chattanooga, common....	..	5¾	5½
Tennessee Railway, Light & Power of Chattanooga, preferred...	6	27	28
United Light & Railways of Grand Rapids, common	4	38	38
United Light & Railways of Grand Rapids, preferred	6	68	68
Western Power of San Francisco, common.....	..	14	14
Western Power of San Francisco, preferred.....	6	54	54
Western Union Telegraph of New York.....extra		92	94¼
Industrials—			
Electric Storage Battery of Philadelphia, common	4	60	60
General Electric of Schenectady.....	8	160	157
National Carbon of Cleveland, common.....	8	73	74
National Carbon of Cleveland, preferred.....		*133	133
Westinghouse Electric & Mfg. of Pittsburgh, common.....5+extra		*52¾	50½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	68½	63

*Last sale.